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OCULAR MANIFESTATIONS OF INTRACRANIAL TUMORS

ALAN C. WOODS, M. D.
Baltimore

THE localization of intracranial tumors is one of the major diagnostic problems of the neurosurgeon. The final diagnosis must be made from the symptoms, the neurologic findings, the ocular manifestations and ventriculography. Of these, ventriculography—the study of the alterations of the ventricular shadows on roentgenograms after the introduction of air into the ventricular system, a procedure introduced by Dandy in 1920[1], is undoubtedly the most valuable method for diagnosis and localization of cerebral tumors. However, the general symptoms and the changes in the eye frequently give invaluable information on the extent of the cerebral lesion and its involvement of the neighboring neuro-pathways. From the standpoint of the neurosurgeon, how must the results of an eye examination be interpreted, and what is the localizing significance of the ocular changes?

The examination of the eyes of a patient with a brain tumor may be entirely negative. Such a negative examination is presumptive, but not absolute, evidence against the presence of intracranial pressure, and is definite evidence that the cerebral visual pathways and the neuro-mechanism of the ocular musculature are not involved by the intracranial lesion.

The examination of the eyes may reveal positive findings. These positive findings may be choked disc, primary or secondary optic atrophy, involvement of the papillomacular bundle with defects in central vision, paralysis of the nerves sup-

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plying the extra- and intra-ocular muscles, defects in the visual fields, or combinations of these. Proptosis of one eye may be present, indicating spread of the tumor to the orbit.

How must these fundus changes, ocular paralyses, and field defects, and their various combinations and associated symptoms be interpreted?

1. Fundus Changes Due to Intracranial Tumors

Edema of the optic nerve may be secondary either to an inflammatory lesion in the nerve, an optic neuritis, or be the

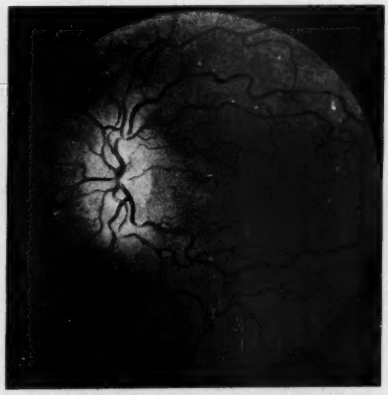

Fig. 1. Early choked disc: Blurring of the neuroretinal margins, more marked at upper and lower poles of the disc.

result of increased intracranial pressure—choked disc. Optic neuritis does not concern us in this discussion. It is of interest only because it is often indistinguishable ophthalmoscopically from choked disc. It is differentiated by the demonstration of an inflammatory cause for the lesion and the greater and more abrupt visual failure which usually accompanies it.

Choked disc is manifested first as a blurring of the neuroretinal margins, more marked at the upper and lower poles of the disc (Fig. 1). The entire temporal side of the disc is occupied by the papillomacular bundle running to the fovea, while the nasal side of the disc is occupied by the fibers running to the nasal half of the retina. The fibers running to the upper and lower parts of the retina are therefore closely packed together at the upper and lower poles. Since the

edema lies in the meshes formed by the interlacing of the nerve fibers and the lamina cribrosa, it will be most manifest where these fibers are thickest. As the edema of the disc progresses, the blurring extends to both the nasal and temporal portions of the disc; the physiologic cup is obliterated; the lamina cribrosa is obscured; the internal limiting membrane of the retina is undermined, and the retina may be raised in small folds. Engorgement and tortuosity of the retinal veins may occur early. As the papilledema progresses, small vesicles form beneath the limiting membrane of the retina, frequently occur along the fibers holding the macular area to

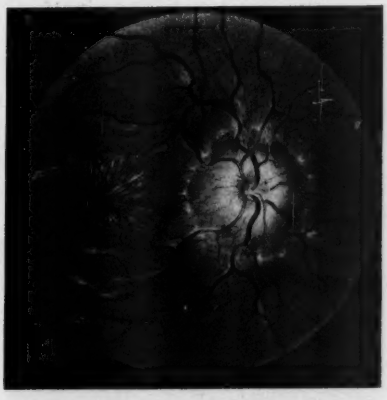

FIG. 2. More advanced choked disc: Small vesicles have formed beneath the limiting membrane of the retina producing a macular star.

the underlying choroid, and may finally produce a macular figure (Fig. 2). Other whitish areas appear throughout the fundus as a result of swelling and degeneration of the nerve fibers.

The histologic picture is edema between the nerve fibers, venous and lymph stasis, and hydrops of the sheath of the nerve (Fig. 3). Gjessing[2] believes that a choked disc usually takes about fourteen days to develop, although with acute high pressure it may develop more abruptly, and with low grade pressure it may develop more slowly. In contrast to the rather sharp visual failure that usually accompanies optic neuritis, normal vision may persist for a long time with high grade choked disc. In the absence of inflammation the optic

FIG. 3. Choked disc: Photomicrograph showing edema between the nerve fibers, venous and lymph stasis, and hydrops of the sheath.

nerve fibers tolerate well high degrees of pressure, although ultimately they degenerate and the nerve goes into secondary atrophy with irregular and often indistinct neuroretinal outlines, glial tissue formation over the cup, often extending along the perivascular spaces a short distance out from the nerve, and a dirty gray color. (Fig. 4.)

There have been many investigations and numerous theories on the pathogenesis or mechanism of choked disc. Suffice it

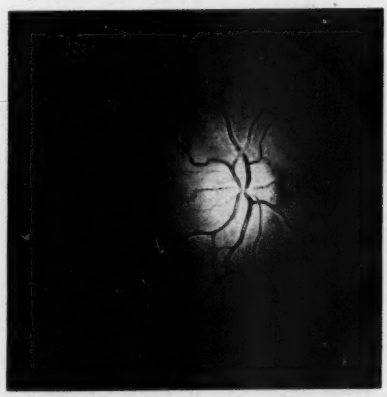

FIG. 4. Secondary optic atrophy.

to say that there are probably several factors in the picture, the most important of which are internal hydrocephalus, stasis of the venous sinuses of the cranium, and differences in the intra-ocular and intracranial tension.

Choked disc must be regarded as evidence of increased intracranial pressure, and not necessarily of brain tumor, although the burden rests with the surgeon to prove that a brain tumor is absent. In the absence of other evidence this can usually be done only by ventriculography. It is well known that other conditions than brain tumor can produce increased intracranial pressure.

Choked disc is not an invariable concomitant of brain tumors, but is generally present. Dandy[3] believes that choked disc is absent in only from 10 to 15 per cent of all brain tumors. If the growth is of a sufficient size, choked disc occurs almost constantly with subtentorial tumors and tumors of the posterior cranial fossa, and probably less frequently with tumors of the anterior and middle fossas. Tumors of the midbrain may cause choked disc very early by blocking the normal intraventricular flow with the production of a secondary hydrocephalus. Gibbs[4] has analyzed the symptoms produced by 1545 verified brain tumors, and reports a choked disc of 4 diopters or over occurring in approximately the following frequency:

Frontal lobe tumors 26 per cent.
Parietal lobe 25 per cent.
Temporal lobe 28 per cent.
Occipital lobe 30 per cent.
Hypophysis 0 per cent.
Suprasellar 5 per cent.
Caudate nucleus 9 per cent.
Lenticular nucleus 10 per cent.
Thalamus 12 per cent.
Pineal body 40 per cent.
Midbrain 20 per cent.
Pons 10 per cent.
Cerebellar-pontine angle 45 per cent.
Cerebellum 40 per cent.
Fourth ventricle 45 per cent.

It was formerly suggested that if the choked disc was asymmetrical—greater in one eye than in the other—the tumor lay on the side of the greater choking. More recent investigations, however, have proven this suggestion is not true.

After relief of the intracranial pressure, either by decompression or removal of the brain tumor, the edema of the optic nerve subsides and the choking recedes. Horrax and Height[5] have analyzed 100 cases of choked disc, and have

found that in supratentorial tumors the average time of regression from the time of relief of pressure to the final picture of subsidence of the choked disc was twenty days, while in subtentorial tumors it was eighteen days.

Primary atrophy of the optic nerves is a result of direct pressure on the nerves, the chiasm, or the optic tracts, with a resultant descending atrophy of the optic nerve fibers. There is no difference in the ophthalmoscopic picture of a primary optic atrophy due to pressure from an intracranial tumor and

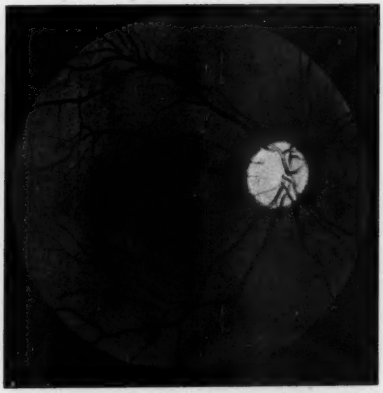

FIG. 5. Primary optic atrophy.

a primary optic atrophy due to central nervous system syphilis, or other neurologic conditions. The disc has normal outlines and a bluish-white pallor, with preservation of the physiologic cup (Fig. 5). In the latter stages the arteries become attenuated. The visual failure in the primary atrophy caused by direct pressure from an intracranial neoplasm is generally more marked than in syphilitic primary atrophy of the same degree of pallor. Primary atrophy is usually secondary to prechiasmal or chiasmal tumors.

The papillomacular bundle, occupying the temporal side of the nerve head and supplying the fovea, is especially susceptible to pressure on the optic nerve. For this reason a central scotoma is often found as an early symptom of pressure on the nerve from an intracranial growth. If a central scotoma is the initial change in the visual field, the later temporal defect often spreads out temporally from the scotoma[6].

2. The Localizing Significance of Ocular Manifestations

In addition to the changes in the optic nerves, intracranial tumors may cause changes in the visual fields from involvement of the visual pathways or centers, and alterations in the movements of the eyes from pressure on the third, fourth, and sixth nerves, or the tracts governing the conjugate movements of the eyes. In some instances these changes give precise information on the localization of the tumor. In the consideration of the localizing significance of ocular manifestations, it will be clearer if we take up the question from the viewpoint of cranial location of the tumor and discuss the ocular changes produced, together with the more important associated symptoms.

Prechiasmal Tumors. The usual tumors found in the region between the optic nerves, and involving the intracranial portions of the nerves, are meningiomas, dural endotheliomas and olfactory groove tumors. The dural endotheliomas frequently undergo invasion with psammoma bodies, which are indicative of the age of the tumor. Gliomas of the optic nerve arise chiefly in the intra-orbital portion of the nerve but may be multiple, or have intracranial extensions.

Prechiasmal tumors produce no characteristic picture. The patients usually show an inexplicable primary optic atrophy. The visual field changes are irregular and vary from concentric contraction to hemianopic defects. If the tumor lies between the optic nerves, the visual field defect may be temporal. Direct pressure on the nerve may produce a central scotoma as the first symptom. Choked disc does not occur. A gradually progressing primary atrophy, with no symptoms of brain tumor, negative neurologic examination, negative sinuses, and negative cerebrospinal fluid, raises the question of the possibility of prechiasmal tumor. The actual diagnosis can, as a rule, be made only be exploratory craniotomy. Dandy[7] has reported two such cases, and goes at length into the diagnostic problem. Suffice it to say here that any gradually developing primary optic atrophy, for which no demonstrable cause can be found, brings up the question of prechiasmal tumor and the consideration of exploratory craniotomy.

Tumors of the Chiasmal Region. To explain the diverse

and complex field changes caused by chiasmal tumors, we must understand the anatomic relationships at the chiasm,

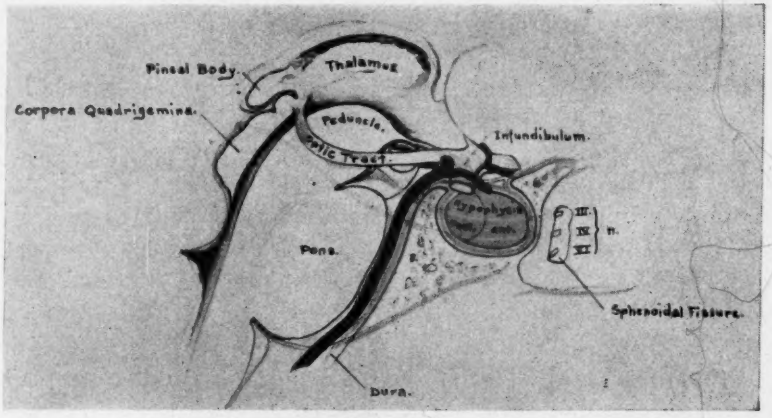

FIG. 6. Diagram to show the anatomic relationships at the chiasm. This is a redrawing and adaptation of a diagram originally made by Dr. C. B. Walker, Am. J. Ophthalmol. *13:* 198, 1930.

the variations from the normal, and the position of the visual fibers in the chiasm itself. (Fig. 6.)

In 79 per cent of individuals the chiasm lies above the posterior portion of the sella turcica and pituitary body, partially on the diaphragm and partially on the dorsum sellae.

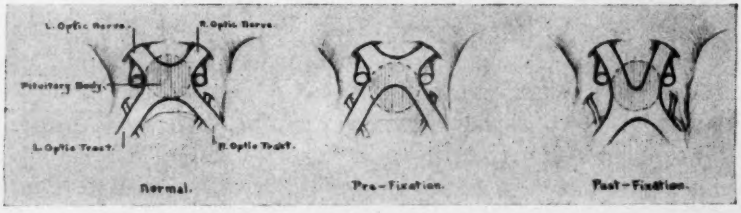

FIG. 7. The relationship of the chiasm to the pituitary body.

The anterior cerebral arteries pass forward over the front of the chiasm connected by the anterior communicating artery. Laterally the sides of the chiasm are in contact with the internal carotid artery, and posteriorly the posterior cerebral arteries pass backwards under the optic tracts. This vascular loop with its posterior connections forms the Circle

of Willis. The posterior wall of the chiasm is in contact with the infundibulum as it passes downwards from the tuber cinereum above to the pituitary body below. In about 17 per cent of individuals the chiasm is in a position of pre-fixation, lying forward over the pituitary body. In 4 per cent of individuals the chiasm is in post-fixation, lying well backwards over the dorsum sellae, the pituitary body being beneath and forward (Fig. 7.)

Figure 8 illustrates the position of the visual fibers in the chiasm. The fibers supplying the temporal retina occupy a

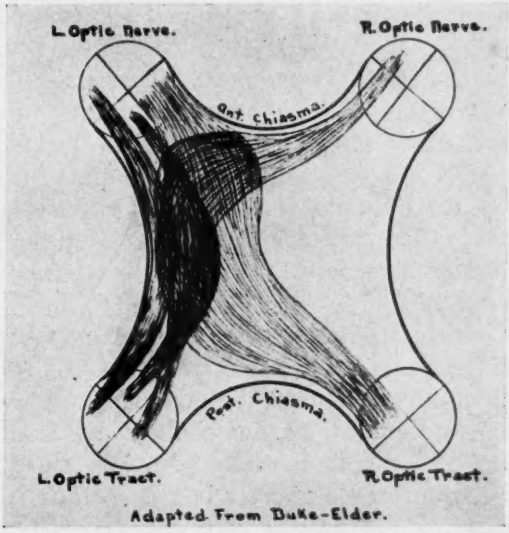

FIG. 8. The position of the visual fibers in the chiasm.

dorsolateral position in the optic nerves and run uncrossed on the outer portion of the chiasm as a flattened oval band. The fibers from the nasal retina which cross to the opposite tract divide into two bundles. The bundle from the upper nasal retina runs over the anterior portion of the chiasm and loops up into the terminal portion of the opposite optic nerve before it turns backwards to the optic tract. The second bundle of fibers from the lower nasal retina, runs forward along the lower anterior portion of the chiasm, loops backward along its own side of the chiasm, and then runs along the posterior portion of the chiasm to reach the opposite tract. The mac-

ular fibers from each eye probably undergo partial decussation, so each optic tract carries fibers from the macular region of each eye. The crossed macular fibers probably lie in the posterior portion of the chiasm. Therefore the fibers in the anterior upper portion of the chiasm represent the upper nasal quadrants of the retina, and the fibers in the lower anterior portion of the chiasm represent the lower nasal quadrants of the retina. The fibers in the lateral wall of the chiasm represent the temporal portions of the retina, but are somewhat mingled with fibers from the nasal retina of the other eye. The posterior portion of the chiasm contains chiefly fibers from the lower nasal retina and the crossed macular fibers.

As a result of these anatomic relations and this arrangement of visual fibers in the chiasm, varied and quite complicated field changes result from intracranial tumors of the chiasmal region. The classic ocular changes produced by adenomas of the hypophysis with the chiasm in normal or post-fixation position are primary optic atrophy and bi-temporal hemianopsia associated with destruction of the bony walls of the sella.

The perimetric studies of Cushing and Walker[8] in 1915 left little to be added to our knowledge of this subject. An enlarging hypophyseal tumor below primarily exerts pressure on the lower anterior portion of the chiasm and the lower inner portion of the optic nerves. If the pressure is directly on the nerve, the papillomacular bundle, which is especially susceptible to pressure, may be involved early with the formation of a central scotoma. If the early pressure is asymmetrical one visual field and nerve will be more profoundly affected than the other. If the pressure is symmetrical the fibers supplying the lower nasal retinal quadrants are involved equally with resultant visual field defects in the upper temporal quadrants affecting the color fields early if not immediately. As the tumor enlarges the chiasm is more compressed and the overlying dorsal fibers supplying the upper nasal portion of the retina are involved, with the resulting visual field defects spreading to the lower temporal quadrant. Ultimately the fibers supplying the temporal portions of the retina are involved by transmitted pressure, and defects appear in the nasal fields. Figure 9 shows the eight stages of visual field

changes as they occur in pituitary adenomas. Cushing and Walker emphasized that if relief of pressure was accomplished up to and including stage iv (typical hemianopsia) full restoration of vision and visual fields was possible. Lillie[9] has recently called attention to the fact that pressure from below may force the chiasm up against the anterior cerebrals and the anterior communicating vessels and so produce grooving of the anterior portion of the chiasm by these vessels,

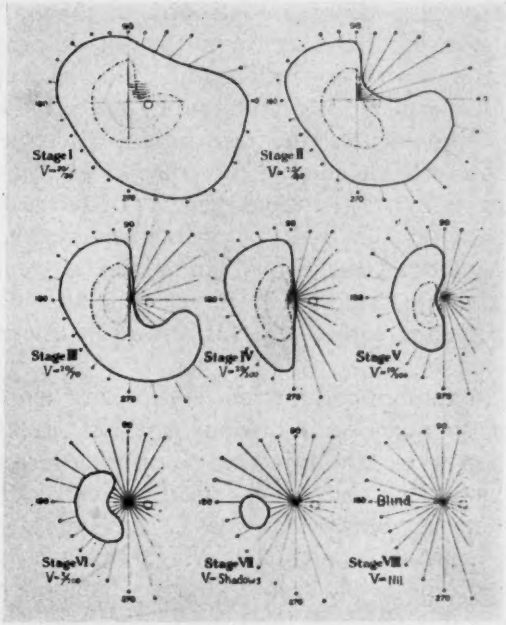

FIG. 9. The eight stages of a progressing right temporal defect. This figure is reproduced through the courtesy of Dr. Cushing from the original article of Cushing and Walker. (See ref. 8.)

with pressure on the fibers supplying the lower nasal retina. Thus the lower temporal quadrants are involved synchronously with the production of complete bi-temporal hemianopsia. Lillie reported four such cases in which this grooving of the chiasm was demonstrable.

Occasionally pituitary tumors produce a homonymous hemianopic field defect, and not the classic bi-temporal hemianopsia. This may be due to one of two factors. The tumor may enlarge laterally and press on the side of the chiasm,

on the mingled nerve fibers supplying the temporal side of one retina and the nasal side of the other retina, or else the chiasm may be in the position of pre-fixation. In the latter case it lies forward over the sella, and a pituitary tumor enlarging laterally may press on one optic tract. The finding of homonymous hemianopsia in such cases may well lead to the error of localizing the tumor further back in the temporal or occipital lobe.

Direct pressure of pituitary tumors on the chiasm and optic nerves usually causes primary atrophy of the optic nerves. Very rarely choked disc is seen with proven chiasmal tumors. Dandy, as a result of his operative studies, believes that papilledema is produced by pituitary tumors only if the pressure on the nerve does not close the intravaginal space sheaths, thus allowing increased intracranial pressure to be transmitted to the optic nerves by way of the continuity of the subarachnoid spaces with the intravaginal spaces about the nerve. Choked disc in a demonstrated chiasmal tumor may also indicate the tumor has grown up into the third ventricle and involved the foramen of Munro with the formation of an internal hydrocephalus.

Suprasellar tumors present the syndrome of temporal field changes and primary optic atrophy without involvement or destruction of the sella turcica. Cushing[10] terms this the chiasmal syndrome. In his classification it may result from suprasellar meningiomas, adenomas of the hypophyseal stalk, or superficial pituitary adenomas which rupture through the diaphragm of the sella, cranio-pharyngiomas or tumors of Rathke's pouch, gliomas of the chiasm, the very rare suprasellar chordoma, aneurysms of the Circle of Willis, and lastly a chronic arachnoiditis.

The most interesting of these lesions are the cranio-pharyngiomas or Rathke's pouch tumors. These have been studied by many investigators and recently by Van Bogaert[11] and Cushing[10]. Embryologically the anterior and intermediate parts of the hypophysis arise from a pouching up of the anterior end of the stomodeum in the fourth fetal month, through the sphenoid partition to the floor of the third ventricle, where they meet a down-pouching of the nervous tissue from the region of the tuber cinereum, which ultimately becomes the

infundibulum. Vagrant epithelial cells may be left anywhere along the intracranial extension of Rathke's pouch, on the hypophyseal stalk, along its base, at its insertion into the hypophysis or in the so-called accessory hypophysis. These anlagen may be the starting point for cystic tumors, the epithelium becoming keratinized and calcified and sometimes casting a definite shadow on roentgenograms. According to their location they may produce different visual field changes. Tumors arising from the infundibulum may press on the chiasm from above and posteriorly involving the fibers from the nasal

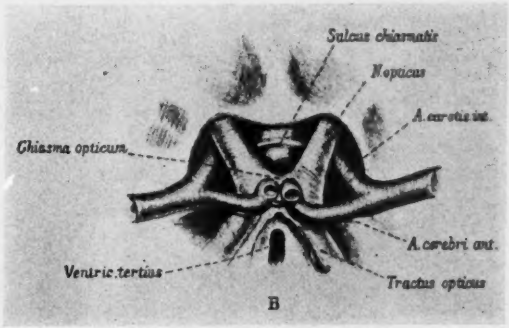

FIG. 10. Both anterior cerebral arteries are so placed that pressure could readily be brought to bear upon the uncrossed visual fibers.
This and the two following illustrations are reproduced through the courtesy of Dr. G. E. DeSchweinitz from his Bowman Lecture. They represent drawings made from dissections by Dr. Schaeffer (Proc. Ophth., Soc. U. K. *43:* 12, 1923.

retina and the crossed macular fibers, with consequent defects in the temporal fields and central scotomas. Tumors from the base of the infundibulum may press on the lower anterior portion of the chiasm, on the fibers supplying the inferior nasal quadrant, with characteristic defects in the upper temporal field and early involvement of the color fields.

Gliomas of the chiasm usually grow irregularly, are infiltrating, and produce bizarre and unpredictable field defects which may attack any portion of the optic nerve, chiasm or tract.

Aneurysm or sclerosis of the vessels of the Circle of Willis produce field defects according to the part of the tract affected. Aneurysms of the anterior cerebral artery may cause a unilateral optic atrophy with early central scotoma from

direct pressure on the nerve. Aneurysms of the posterior communicating arteries primarily affect the optic tracts with resulting homonymous hemianopic visual field defects. Sclerosed internal carotid arteries may groove the lateral walls of the chiasm with resulting binasal visual field defects. De-Schweinitz[12] in his Bowman lecture has called attention to the various abnormalities in the vascular arrangement of the Circle of Willis. Figures 10, 11, and 12 show the variations which occur in the relationships of the Circle of Willis to the optic chiasm. The anterior communicating artery may be

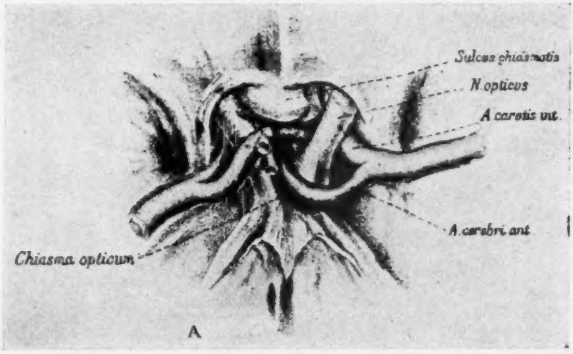

FIG. 11. The right anterior cerebral artery has a chiasmal relation and the left an optic nerve contact.

either in front of the chiasm or lie on it. The anterior cerebrals may form a knuckle over an optic nerve, back on the chiasm, or even on an optic tract. Variations in the posterior cerebral arteries may result in the formation of a vascular knee between the chiasm and the hypophysis, so that the chiasm may be grooved by such a loop pressed upward by an enlarging pituitary tumor beneath. These vascular variations are sometimes the explanation for the occasional bizarre and inexplicable field defects associated with chiasmal lesions.

Paralyses of the extra-ocular muscles rarely occur with tumors of the chiasmal region. They are usually absent if there are visual field defects. To produce visual field defects, the tumor must lie close to the midline and press on the visual fibers. It therefore tends to spare the third, fourth and sixth nerves which lie laterally. If an extra-ocular palsy occurs

with chiasmal lesions, it is usually in the third nerve which lies closest to the midline.

Summing up the ocular changes secondary to tumors of the chiasmal region, the usual picture seen with pituitary adenomas is primary optic atrophy, bi-temporal field defects, which are usually asymmetrical but sometimes symmetrical. In pituitary tumors we usually have bony changes in the sella turcica, while in suprasellar tumors such bony changes are usually absent. In both pituitary and suprasellar tumors the first direct pressure on the optic nerves may cause a central scotoma as the initial symptom before manifest optic atrophy appears. The lateral growth of the tumor and pre-fixation

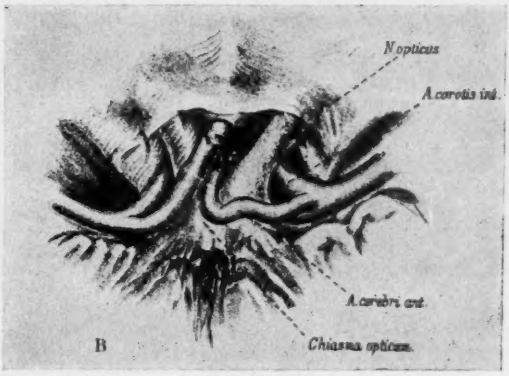

FIG. 12. The right anterior cerebral artery cuts the chiasm in the sagittal plane and the left has a purely optic nerve contact.

of the chiasm may cause pressure to be exerted on the side of the chiasm or on an optic tract, with a resulting homonymous hemianopsia. Aneurysms and sclerosis of the vessels of the Circle of Willis may produce bizarre and often inexplicable ocular manifestations. The field changes may vary from central scotoma to bi-nasal hemianopsia, to a homonymous hemianopsia with slowly developing primary atrophy of the optic nerves. Choked disc occurs only rarely in pituitary lesions. Extra-ocular paralyses are extremely rare and, if present, usually involve the third nerve.

3. TUMORS OF THE CEREBRAL HEMISPHERES

Frontal and Subfrontal Tumors. The most frequent ocular symptom in frontal lobe tumors is choked disc. In Ab-

bot's[13] series 40 per cent of frontal lobe tumors showed choked disc, and in Gibbs'[4] series 26 per cent showed choked disc of 4 diopters or more. Nystagmus is frequently present. This is usually irregular and is probably due to interference with the higher centers governing the coordinate movements of the eyes. It differs from cerebellar nystagmus in its irregularity, cerebellar nystagmus being more rapid and regular. A rare ocular picture, sometimes occurring in subfrontal and olfactory groove tumors, is the Foster Kennedy syndrome[14]. In

FIG. 13. The right fundus (shown on the left) shows optic atrophy while the left shows choked disc. The subfrontal tumor was on the right.

this syndrome the eye on the side of the lesion shows a central scotma with a later developing primary optic atrophy, while the fellow eye shows a choked disc with an enlarged blind spot. (Figs. 13 and 14). There is frequently an associated bilateral anosmia. Foster Kennedy believed this syndrome is due to direct pressure on one optic nerve producing a primary optic atrophy, while increased intracranial pressure produces a contralateral papilledema.

Parietal Lobe Tumors. Tumors of the parietal and frontoparietal area rarely give visual field changes, unless the tumors extend into the temporal lobe. In the recent report of Globus and Silverstone[15] they noted four parietal lobe tumors with definite hemianopic defects in the visual fields. It is interesting that these occurred in encapsulated tumors. Choked disc may occur as a result of increased intracranial pressure,

Gibbs[4] reporting high degrees of choked disc in 25 per cent of his parietal lobe tumors. Paralyses of the extra-ocular muscles are usually not present, although the sixth nerve may sometimes be involved by the general increased intracranial pressure.

Temporal Lobe Tumors. These tumors produce different ocular symptoms according to their location, and sometimes give a syndrome of exact localizing significance. If the tumor lies deeply and medially towards the corpora quadri-

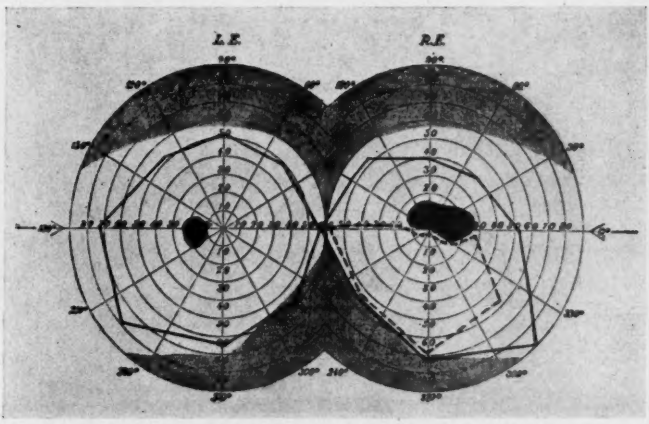

FIG. 14. Perimetric fields in Foster Kennedy syndrome. Same patient as in Fig. 13. Central scotoma of right eye and enlarged blind spot of left.

gemina, anisocoria may result from involvement of the pupillo-motor fibers passing down from the superior colliculus. Tumors lying more laterally and posteriorly directly affect the visual pathways and give characteristic homonymous defects in the visual fields, frequently quadrantic in type. Tumors lying in the anterior portion of the temporal lobe tend to miss the visual pathways and so fail to produce visual field defects. Cushing[17], Traquair[16] and others have pointed out that the characteristic of hemianopic field defects in temporal lobe tumors is asymmetry, the greatest defect being in the contralateral visual field. The explanation of this peculiar finding apparently lies in the arrangement of the visual fibers in Meyer's loop. Meyer, studying the course of the visual fibers

by the degeneration method, found that the fibers of the optic radiation plunge far forward in the temporal lobe, sweep around the inferior horn of the lateral ventricle, and then turn backward to course through the temporal and occiptal lobes to the cuneus (Fig. 15). Globus and Silverstone[15] suggested that a temporal lobe tumor advancing from within interrupts first the more median fibers of Meyer's loop which represent the opposite nasal retina and so produce there the

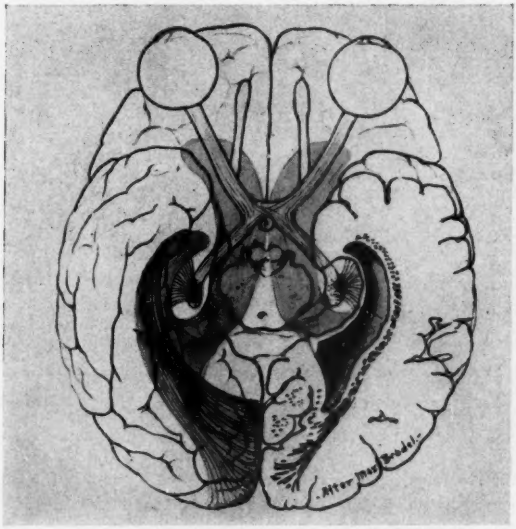

FIG. 15. The fibers of the optic radiation plunge far forward in the temporal lobe, sweep around the inferior horn of the lateral ventricle and then turn backward to course through the temporal and occiptal lobe to the cuneus.

greatest defect. They found, however, that other tumors advancing from without inward also produced increased visual field defects on the opposite side. To explain this, they suggested that the fibers representing the opposite nasal retina rotated in their passage through Meyer's loop so they might ultimately lie on the external part of the radiation and thus be involved by tumors advancing from without. Tumors involving either the upper or lower portions of radiation would produce quadrantic defects rather than complete hemianopsia.

Choked disc is a usual concomitant of temporal lobe tumors. In Cushing's[17] study of the ocular changes produced by temporal lobe tumors, choked disc was present in 90 per cent of the cases. In our experience it has likewise been an almost constant finding. Gibbs[4], however, reports high degrees of choked disc in only 28 per cent of his temporal lobe tumors.

Visual hallucinations and uncinate gyrus attacks are frequent in temporal lobe tumors and are of great localizing significance. The visual hallucinations occur in the blind field, and are usually described by the patient as complicated and bizarre auras—gargoyles, fantastic figures, etc. Such visual hallucinations were present in 26 per cent of Cushing's cases[17], and were associated with the characteristic uncinate gyrus attacks of petit mal. Duke-Elder[18] believes this combination of visual hallucinations and uncinate gyrus attacks is due to the simultaneous involvement of the visual pathways in Meyer's loop and the uncinate process of the hypocampal gyrus.

Occipital Lobe Tumors. Tumors of the occipital lobe usually produce the general picture of bilateral choked disc and crossed hemianopsia, but in this eye picture there is little of localizing significance. Gjessing[2] mentions the peculiar visual hallucinations in the blind field complicating these tumors. These visual hallucinations consist of zigzag lines and flashes of light, in contradistinction to the bizarre figures seen in association with temporal lobe tumors and uncinate gyrus attacks. Occipital lobe tumors, as a rule, produce few associated generalized symptoms, there being a rather characteristic absence of other neurologic signs.

Tumors of the Basal Ganglia. Tumors of the striate body may or may not produce ocular manifestations. Globus and Silverstone[15] found no defects in the visual fields, or ocular changes of any localizing significance, in these tumors. My experience has been essentially the same. The striate body lies in close proximity to the optic tracts and if the tumors are infiltrating they may involve the visual pathways directly; or if not infiltrating, they may involve them through transmitted pressure, producing homonymous quadrantic or hemianopic defects. Tumors of the basal ganglia or third ventricle,

through involvement of the foramen of Munro, frequently produce an internal hydrocephalus with resulting choked disc. There is, however, nothing characteristic or constant in the ocular picture of basal ganglia tumors.

Pineal Gland Tumors. The pineal gland lies directly above the quadrigeminal bodies, and overlies the Aqueduct of Sylvius, with the posterior longitudinal fasciculus governing the conjugate movements of the eyes, and the nucleus of the third nerve immediately beneath. A tumor of the pineal gland therefore exerts pressure downwards on the quadrigeminate plate and backwards on the Aqueduct, closing the intraventricular communication and giving secondary pressure on the third nucleus and the posterior longitudinal fasciculus. These tumors, as a rule, characteristically produce symptoms of third nerve paralysis, conjugate paralyses and deviation of the eyes, and choked disc.

The first ocular manifestation is usually a bilateral ptosis followed later by involvement of the other branches of the third nerve. As the pressure is exerted ventrally, conjugate paralysis of the eyes appears. The first conjugate paralysis is usually paresis of the upward gaze. This is frequently followed by conjugate deviation of the eyes laterally, and finally by almost complete ophthalmoplegia. Synchronously, or preceding these symptoms, there is bilateral choked disc.

The successful removal of a pineal gland tumor is usually followed by relief of these pressure symptoms, although in the one such case I have seen the paresis of the upward gaze persisted.

Tumors of the Brain Stem. These tumors, due to their proximity to the third and fourth ventricles and the Aqueduct of Sylvius, tend to block the intraventricular communication and cause early internal hydrocephalus. Since the nuclei of many of the cranial nerves lie in the midbrain, tumors in this region usually produce various combinations of paralyses of these nerves, according to their location. Likewise, through their proximity to the sensory and motor pathways tumors of the midbrain tend to produce definite sensory and motor phenomena with ataxia. As they lie remote from the visual pathways they do not produce changes in the visual

fields. The general picture produced by brain stem tumors, therefore, is choked disc, paralyses of various cranial nerves, crossed sensory and motor disturbances, and normal visual fields. According to the involvement of the various cranial nerves, the exact position of these tumors may be rather accurately localized. This localization, however, is of little importance for practically all of these tumors are inoperable. The various syndromes produced by tumors of the brain stem are listed by Abbot[13] as follows:

1. *Benedikt's syndrome* (from deep tumors at the level of the red nucleus) bilateral choked disc, homolateral paralysis of the third nerve, with crossed ataxia, tremors on the opposite side, and involvement of the underlying pyramidal tract.

2. *Weber's syndrome* (from tumors of the cerebral peduncles) bilateral choked disc, homolateral third nerve palsy, and crossed hemiplegia.

3. *Nothnagel's syndrome* (from tumors involving the third nerve nucleus) bilateral choked disc, partial or complete third nerve palsy and crossed ataxia.

4. *deRaymond's syndrome* (from tumors of the pons at the level of the sixth nerve), bilateral choked disc, homolateral paralysis of the sixth nerve, crossed hemiplegia, and crossed sensory disturbances.

5. *Millard-Gubler's syndrome* (from tumors of the pons at the level of the sixth and seventh nerves) bilateral choked disc, homolateral paralysis of sixth and seventh nerves, crossed hemiplegia, and sensory disturbances.

6. *Foville's syndrome* (from tumors of the pons at the level of the seventh nerve) bilateral choked disc, crossed hemiplegia and homolateral paralysis of the facial nerve. If tumors at this level extend upwards into the lateral fillet, there results involvement of the pathways from the labyrinth to the nuclei of the ocular muscles on the floor of the aqueduct and the fourth ventricle, with resulting disturbances of the conjugate movements of the eyes.

Subtentorial Tumors. The posterior cranial fossa forms a well limited unit between the bony floor and sides of the cranium, the pyramids, and the rigidly stretched tentorium cerebelli above. It is bounded by large venous sinuses. An increase in pressure in the subtentorial space gives immediate impairment of the free circulation in the venous sinuses and pronounced symptoms of increased intracranial pressure. Space-occupying lesions in the subtentorial region may exert pressure downwards with closure of the foramens of Magendie and Luschka, and the formation of internal hydrocephalus. Choked disc and severe headaches are therefore early

signs of subtentorial tumors. Visual field changes are not produced directly by subtentorial tumors, although if there has been a longstanding internal hydrocephalus with a high degree of choked disc and subsequent secondary atrophy, constriction of the visual field occurs.

Nystagmus is a common finding in cerebellar tumors. It is probably due to interference with the normal cerebellar stimulus which passes from the cerebellum through Dieter's nucleus to the posterior longitudinal fasciculus. Space-occupying lesions of the cerebellum, extending anteriorly or located anteriorly, may produce local pressure on the floor of the Aqueduct and the fourth ventricle with resultant paralysis of the extra-ocular muscles. The third nucleus, due to its location, is most often involved. The typical cerebellar syndrome is bilateral choked disc, occasional bilateral partial paralysis of the third nerve, nystagmus, and normal visual fields. The general symptoms are ataxia and incoordination. The general signs of pressure and ataxia are usually seen before there is any involvement of the third nerve.

Cerebellar Pontine Angle Tumors. These tumors give a very characteristic syndrome with a rather typical ocular picture. They are, of course, easily diagnosed on account of the telltale deafness which is an early symptom. They tend to close the Aqueduct early with resulting hydrocephalus and high degree choked disc. Expanding lesions at the cerebellar pontine angle gradually involve the adjacent cranial nerves, especially the sixth, giving a homolateral paralysis of the external rectus; the fifth, giving homolateral anesthesia of the cornea; the seventh, giving homolateral facial palsy; and the eighth, giving homolateral tinnitus and deafness. The angle syndrome therefore is bilateral choked disc, homolateral corneal anesthesia, and occasionally paralysis of the external rectus muscle. The general neurologic disturbances are homolateral tinnitus and deafness, first sensory and later motor involvement of the trigeminus, homolateral facial paralysis of the peripheral type and slight ataxia.

Comment

From this epitome of the ocular manifestations of brain tumor it is evident that only a limited number of intracranial tumors produce ocular manifestations of exact localizing significance. Certain tumors of the chiasmal region, the temporal lobe, the brain stem, the cerebellar pontine angle, and the pineal body may give ocular manifestations which permit the exact localization of the tumor, but all tumors of these regions do not constantly produce the characteristic picture. In the instance of chiasmal tumors I have pointed out at some length the sources of error which may lead to incorrect diagnosis. With the exception of the rare Foster Kennedy syndrome in frontal lobe tumors, and the characteristic syndrome of temporal lobe tumors sometimes observed, there is little in the ocular picture which permits localization of tumors of the cerebral hemispheres. Likewise, as a rule, there are no characteristic ocular signs in tumors of the third ventricle, basal ganglia, or cerebellum, which permit exact localization.

In general, choked disc is usually found when the intracranial pressure is elevated, but a small number of brain tumors, from 10 to 15 per cent, never produce the picture of papilledema. In cases of suspected intracranial lesions, a careful ophthalmologic examination with perimetric studies will usually tell us if there is increased intracranial pressure, and will always tell us if the visual pathways and the ocular nuclei are involved. The progress and extent of the ocular changes usually gives strong presumptive evidence as to the nature of the lesions. The changes produced by tumors are usually slow and gradual in their development. The changes produced by hemorrhage, inflammation, and abscess are usually sharper and more abrupt.

In many instances the ocular changes permit exact localization of the lesion. In many other instances, however, we find only the general picture of choked disc, hemianopic field defects, and occasional paralysis of the sixth nerve. Localizing significance should not be unduly given to such a picture. The final diagnosis should be made on the relation of these findings to the general neurologic picture, or especially on ventriculography.

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A SECONDARY INGUINAL HERNIA WITH BILATERAL INDIRECT INGUINAL HERNIA

JOHN VENABLE, M. D. *and* HOMER BLINCOE, M. D.
Emory University, Ga.

THE occurrence of multiple unilateral hernial sacs has been reported by many authors with the warning that, in any inguinal hernia, additional sacs should be sought. Several have mentioned the presence of an additional sac as explanation for a recurrence of another inguinal hernia on the same side, after apparently perfect operative results. Hotchkiss (quoted by Koch) reported in 1918, and his findings were confirmed in 1924 by Koch[1], that smaller direct inguinal hernias are not infrequently associated with larger indirect hernias. Koch, in emphasizing this, reports a case of bilateral indirect hernia which at operation was found to have small bilateral direct hernial sacs as well. Bishop[2] and Dederer[3] have also emphasized the importance of looking for additional sacs. There are reports of other cases in the literature presenting various forms of multiple unilateral inguinal hernia, but all of them refer to a combination of direct and indirect on the same side.

In reporting a case of associated oblique and direct inguinal hernia on the same side, Rutherfurd[4] (1889) stated: "The chief point of interest in the preparation was the demonstration which it afforded of the relation of the conjoined tendon to inguinal hernia." The older textbooks of anatomy described the falx inguinalis as extending from the lower border of the internal oblique and the transverse muscles of the abdomen downward to be attached to the crest of the pubis and to the pectineal line immediately behind the subcutaneous inguinal ring. Many descriptions, particularly the older ones, describe it as extending only over the medial two-thirds of Hesselbach's triangle. This triangle is bounded by the inferior epigastric artery laterally, the lateral border of the rectus abdominis muscle medially, and the inguinal ligament inferiorly. In the ninth edition of Morris' Textbook of Anatomy[5]

From the Department of Gross Anatomy, Emory University School of Medicine.

this structure is defined as the falx inguinalis, but there is an additional structure located lateral to this, the interfoveolar ligament, which arches from the lower border of the oblique and transverse muscles to the superior ramus of the pubis, passing just medial to the abdominal inguinal ring and lending strength and support to the medial border of that ring. Located between these two structures is a thin area through which the fascia transversalis may at times be seen. It is usually this thinner area which is either carried out or split by the direct form of hernia.

No previous report has been found, however, in which the neck of the medial sac left the abdominal cavity from Hesselbach's triangle (medial to the inferior epigastric artery) and then passed lateral to the artery through the abdominal inguinal ring, without involving the falx inguinalis or the interfoveolar ligament.

This condition in the cadaver of an adult male was found in the course of dissection in the anatomic laboratory at Emory University. No history is available, but the presence of some type of scrotal hernia was suspected at the time the body was received because of the large size of the scrotum. The tissues were already fixed by the embalming process and no external examination could be made. Because of the suspected condition, special care was taken in the dissection so that the anatomic structures involved in inguinal hernia might be demonstrated to the students.

Upon laying bare the parts involved there was found in each inguinal region a hernial sac having the usual relations of an indirect hernia to the spermatic cord. Each sac passed through the abdominal inguinal ring and came to lie superficial to and slightly above the spermatic cord, in which relationship each passed through the canal and out of the subcutaneous inguinal ring. Each sac extended into the scrotum of the corresponding side where on subsequent dissection it was found to be entirely separate from the tunica vaginalis testis. Its coverings from without in were demonstrated to be skin, superficial fascia (dartos), intercrural fascia, cremasteric fascia and cremasteric muscle, infundibuliform fascia (transversalis fascia), and extraperitoneal fat. Neither sac, in the collapsed state of the parts, contained viscera. The

right sac was about twice the size of the left and descended to a somewhat lower level. The attention of the students was called to the dissection at this time as being probably a bilateral congenital hernia into the funicular process (Callander[6]), or possibly an acquired bilateral indirect inguinal hernia.

When the abdominal cavity was opened, however, it was found that on the left side there was an additional sac admitting the tip of the little finger and extending in an anterior and slightly lateral direction for about 1 cm. before turning medially to run in the inguinal canal above and slightly behind the other sac for a distance of about 2 cm. in the canal.

FIG. 1. View of the posterior aspect of both lower quadrants of the abdominal wall as seen from the inside. The flaps are pulled forward and outward, the cavity seen in the center of the picture being that of the pelvis. An arrow points to each of the hernial sacs and to each of the peritoneal dimples. The superior surface of the bladder may be seen with the ureteral folds on each side.

The middle inguinal fossa had disappeared due to the fact that the inferior epigastric artery had been displaced medially, possibly by the pull of the larger sac. The obliterated hypogastric artery formed a fold which was slightly larger than usual and separated the necks of the two sacs. The neck of the larger sac was above and lateral to this fold and that of the smaller sac below and medial to the fold. There were also two small but distinct dimples in the peritoneum of this region, one on the lateral umbilical fold just above the necks of the two sacs and one just below the two sacs on the same

fold, (Fig 1). On the right, there was nothing unusual, the hernia being a typical indirect inguinal hernia, apparently of long standing as the inferior epigastric artery on this side was also pulled medially.

On the left, the larger sac began with its neck above and lateral to the lateral umbilical fold, passed forward and medially through the abdominal inguinal ring and lateral to the artery to enter the canal, where it lay superficial to and slightly above the spermatic cord. In the scrotum were the usual relations. The smaller sac began below and medial to the lateral umbilical fold and passed anteriorly and slightly laterally for a distance of about 1 cm., in this course passing between the obliterated hypogastric artery behind and the inferior epigastric artery in front, the latter having been medially displaced by the pull of the larger sac. In this course the smaller sac crossed to the lateral edge of the interfoveolar ligament (medial border of the abdominal inguinal ring) and entered the inguinal canal through the abdominal ring lateral to the interfoveolar ligament and lateral to the inferior epigastric artery. It extended for a distance of about 2 cm. in the inguinal canal, failing by 1 cm. to reach the subcutaneous ring. In the canal it was located above and slightly behind the larger sac and was covered by extraperitoneal fat, fascia transversalis, and cremasteric fascia.

The falx inguinalis (conjoined tendon) and the interfoveolar ligament were apparently normal. Both arched downward from the lower borders of the internal oblique and transversus muscles, the former to attach to the crest of the pubis and the pectineal line, the latter to the superior ramus of the publis farther laterally. The thin area normally lying between these two structures, usually a thin fascia, was apparently as thick and as strong as they, amounting to a fusion of the two ligaments.

The neck of the smaller sac must be described as opening from Hesselbach's triangle, inasmuch as it was medial to the lateral umbilical fold. It, however, did not carry conjoined tendon out with it or split that structure, but had worked its way laterally to pass around the free edge of the interfoveolar ligament, which brought it to the lateral inguinal fossa lying between the peritoneum and anterior abdominal wall. From

this location to its termination in the canal it was a typical indirect inguinal hernia.

It is possible that the above mentioned dimples could have served as a "hole in the dyke," or nucleus for additional sacs, if herniorrhaphy had been carried out on this patient, even if both sacs had been discovered and ligated.

Discussion

This case serves to add to the data already collected that there may be more than one sac on the same side in inguinal hernia. The other reported cases describe these as one direct and one indirect on the same side, but in this cadaver there were bilateral indirect hernias and one unusual indirect hernia on the left which bore the relations and coverings of an indirect hernia although it began in the region of a direct. Such cases of superimposed or potential hernias may serve to explain certain recurrences of hernia in patients whose operations were technically successful and in whom no infection occurred.

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THE SURGICAL TREATMENT OF DUODENAL LESIONS

J. Shelton Horsley, M. D.
Richmond

THIS paper does not pretend to list and describe the various operative procedures employed for surgical lesions of the duodenum. Obviously such information is readily accessible in the books of your library. It might be of interest, however, to discuss some of the less common conditions, and to recount some of my observations, even though my own experience is not so extensive as that of those who have access to a large amount of clinical material in gastro-intestinal surgery.

We cannot wholly ignore the most common lesion of the duodenum,—peptic ulcer and its sequelae and complications. In the common or garden variety of duodenal ulcer, especially in the young, medical treatment is by all means the preferable therapy. Operation of any kind should not be undertaken in such cases, unless there is perforation or undue bleeding, until a course of competent medical treatment has been given. In the older cases, with obstruction or stricture, the classic posterior gastro-enterostomy is a satisfactory operation. In some posterior penetrating ulcers in the first part of the duodenum, a partial gastrectomy, removing the perforated area with the electric cautery and using a modification of the Billroth-I operation, gives good results. The indications for such an operation, however, are not frequent, though when they do arise this procedure is gratifying. In duodenitis, which is attracting more attention at present, providing physiologic rest for the duodenum by posterior gastro-enterostomy or by some application of side-switching such as the Devine operation is often beneficial.

Whenever a partial gastrectomy is done for peptic ulcer with high acid values of the gastric juice, it is particularly desirable to unite the stump of the stomach to the duodenum, because it has been convincingly shown by the physiologists that the sensitiveness of the intestinal mucosa to the acid gastric juice increases from the duodenum down to and including the

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colon. While a Billroth-II type of operation may be satisfactory for lesions in which the free acid of the gastric juice is absent or very low, as in many cancers, jejunal ulcer will almost certainly result from gastro-enterostomy and often from a Billroth-II gastrectomy when acid values of the gastric juice continue high, and the last stage of this patient with a jejunal ulcer may readily be worse than the first with the ulcer in the duodenum. Even for cancer a form of Billroth-I operation is usually more satisfactory if it can be applied. Dr. Fordyce B. St. John has reported a case of Billroth-II partial gastrectomy for cancer of the stomach in which the patient later died of a perforated jejunal ulcer. If the lower acid is due to the presence of the cancer, and the removal of the cancer restores the proper physiologic function of the stomach, we may expect a return to normal acid values of the gastric juice,—with a consequent danger of jejunal ulcer.

Pyloroplasty

In a few cases in which medical treatment does not avail and the ulcer is limited to the first portion of the duodenum with no adhesions or adhesions only to the gallbladder, some type of pyloroplasty is often indicated. The pyloroplasty that I have advocated has a limited field, and I am using it less frequently than I did ten years ago; but I still think there is a place for it even though small—a field, as just indicated, in which medical treatment is not satisfactory and particularly when the gastric acid values are high. A recurrent duodenal ulcer is better than a jejunal ulcer.

Undoubtedly in some of these recurrent ulcers there is, as Harvey Cushing has called to our attention, a neurogenic origin for the ulcer. I am unwilling to hold that the neurogenic theory can account for all peptic ulcers, but in those that recur in spite of all that is done it would seem that vagal stimuli from the brain are responsible for the high degree of spasm, hyperemia and excessive gastric secretion which are so often precursors of a peptic ulcer. Time does not permit to go into this fully, but I believe it is well in recurrent ulcers or when the acid of the gastric juice is high to follow the suggestion of Walter Hughson and sever the anterior branches of the vagus nerve. This does not remove all the vagal nerve supply,

but it would seem from the experiments of Hughson that it tends to lessen the spasm which is an accompaniment of vagal stimulation.

Cholecystoduodenostomy and Choledochoduodenostomy

Three conditions concerning the duodenum that are interesting, though not so common as peptic ulcer, are obstruction in the common bile duct, obstruction in the distal duodenum, and duodenal fistula. For obstruction in the terminal portion of the common bile duct the usual procedure is to anastomose the gallbladder with the duodenum. Certainly the emptying of the bile into the duodenum is depositing it into its normal, physiologically provided receptacle. The anastomosis of the gallbladder to the stomach for the cure of duodenal ulcer is quite unphysiologic, though in obstruction from cancer in the head of the pancreas, when acid values in the stomach are low, it may be advisable as an emergency operation. According to the physiologists the bile is very slightly alkaline, or almost neutral. While it is true that there is some undetermined substance in the bile the absence of which seems to predispose to ulcer, the pancreatic juice is the chief source of alkalinity in the duodenal contents. Certainly the neutral or very mildly alkaline bile does not compare with the very strongly alkaline pancreatic juice, and when the gallbladder is joined to the stomach the bile can hardly have any effect in neutralizing the acid gastric juice. Then, too, in peptic ulcer the acid values of the gastric juice are high and the reflux of acid into the gallbladder produces a decidedly irritating effect upon the gallbladder itself. Besides these things, unless there is obstruction in the common duct but little bile would be excreted through the gallbladder. This is well known by surgeons who drain the gallbladder after extracting stones. When the inflammation clears up and the common duct becomes patent, only a very small amount of bile comes through the cholecystostomy opening. When there is an obstruction in the common duct, however, there may be no other resource than to unite the gallbladder to the duodenum. Certainly if it is to be joined to any portion of the gastro-intestinal tract the duodenum would appear to be the most favorable site. The bacterial growth in

this region is small and the mucosa is accustomed to the bile which is normally delivered into the duodenum. However, even in such favorable conditions, sooner or later an ascending hepatitis almost always occurs.

John S. Horsley, Jr., in 1926, reported a series of experiments on nineteen dogs to compare the relative merits of cholecystogastrostomy and cholecystoduodenostomy, and to determine the effects of these operations on the gallbladder, bile ducts and liver. Following operations of both types, definite infection and pathologic conditions of gallbladders, bile ducts and livers were found.

While in the human being it may be possible that this type of hepatitis may exist for a long time without markedly untoward effects, it cannot be considered a favorable occurrence and may result in a serious pathologic condition. If this ascending hepatitis occurs when the protection of the valves of the cystic duct is present, it may be assumed that direct anastomosis with the common bile duct may be even more disastrous. In a patient of mine, Mr. R. B. D., in whom the gallbladder had been removed and there was obstruction at the end of the infected common duct, the common duct was united to the duodenum by a lateral anastomosis. The patient's immediate recovery was satisfactory, but eventually he had further trouble. An x-ray film following a barium meal in the stomach showed that under ordinary pressure the barium was regurgitated even up into the finer hepatic ducts of the liver. The patient died four years after the operation.

It may be that some of these patients acquire a kind of immunity. In this particular patient there was a lateral anastomosis. The end-to-side union of the stump of the common duct to the duodenum may not be fraught with such dire consequences, but it is suggestive that even then, the protective influence of the sphincter of Oddi being absent, a reflux may occur.

If there is any possible way of restoring the continuity of the common duct so the bile can go through its natural channel, it would seem far better; though in certain cases "beggars can't be choosers" and it may be necessary to make some such union even though we deplore it.

The operation that has been practiced by Lahey and others

of freeing the distal portion of a biliary fistulous track and transplanting it in the bowel has no proper part in surgery of the duodenum, because it is usually placed in a loop of the jejunum. However, as Lahey himself has said, it is not much of an operation, and only serves as a last resort when nothing else will do.

The main impressive feature about surgery of the biliary tract as concerns an artificial communication with the duodenum, is that it should be avoided unless it is impossible to re-establish the normal communication of the common duct.

Duodenal Fistula

An annoying lesion of the duodenum is fistula. This is probably not so common as it was formerly, but occasionally a duodenal fistula occurs which may give great concern. The prophylaxis of this lesion is important. A duodenal fistula may result from the pressure of a drainage tube in the common duct. When it is necessary to drain the common duct it is important that the duodenum be protected by bringing over peritoneal-covered fat, usually gastrocolic omentum or great omentum, and suturing it over the duodenum so that the tube rests not directly upon the duodenal wall but upon this mass of fat.

Duodenal fistulas occasionally follow the Billroth-II type of partial gastrectomy in which the duodenum is left as a blind pouch. This is another reason for urging the Billroth-I type wherever it is possible. Occasionally in the Billroth-II type, even though there is no definite mechanical obstruction, the duodenal contents back up and dilate the stump of the duodenum. Then, too, if the tissues are scanty in this neighborhood and the duodenal stump cannot be well covered, a fistula may result.

Suturing the duodenum when it is necessary to open it for excision of a tumor or for extraction of a stone in the end of the common duct, should be done most carefully. Unless the duodenum is somewhat dilated it is preferable to make a transverse incision. When the duodenum is large, the incision to reach the terminal stone or the growth should be made in any direction that will give the best exposure. Before incising the duodenum for extraction of a stone in the terminal common duct, a procedure which I think was first advocated by the

late Charles McBurney, every effort should be made to remove the stone through an incision in the common duct itself. Occasionally, however, a stone is so impacted that this cannot be done, and with a uterine probe or common duct forceps placed in the common duct and shoved down rather forcibly on the stone, the ampulla may be made to protrude into a short incision in the duodenum and the stone extracted by a small cut onto the stone. Hemostasis must be secured, for these small wounds in the duodenal mucosa, particularly with the jaundice usually present when there is an impacted stone, may lead to a serious hemorrhage.

The excision of a malignant growth in the ampulla of Vater can also be made through an incision in the duodenum. I have never had occasion to do this operation, but it would seem plausible to excise the neoplasm through an incision in the duodenum, using preferably an endotherm, or, if the lesion is too extensive, to insert radon implants.

In closing the duodenum the wound is accurately approximated, preferably with silk or linen, turning in a very small margin of the tissue and using a continuous suture. Over this is placed a series of interrupted mattress sutures of fine tanned or chromic catgut, and the ends are left long, threaded in a needle and passed through the adjacent peritoneal covered fat, probably omentum. Drainage should never be placed in immediate contact with the sutured wound, though it may be introduced to a short distance from it if the wound is protected by fat.

When a fistula has occurred its treatment often demands much ingenuity. If the fistula is comparatively small, merely keeping the margins of the wound protected, frequent change of dressings, or gentle packing of the wound with a beef broth mixture, is often satisfactory. (The formula for this mixture is as follows: Bacto brain veal broth, dehydrated, is used by dissolving 37 Gm. in 1000 c.c. of 0.1 normal hydrochloric acid and sterilizing this solution in the usual manner; or 13 Gm. of Bacto dextrose broth, dehydrated, may be dissolved in 1000 c.c. of 0.1 normal hydrochloric acid. To prevent hemolysis 8 grams of sodium chloride per liter should be added.)

When, however, the fistula is large and the discharge of duodenal contents abundant, the problem becomes a very serious one. It has been recommended that an electric pump be used to draw off the secretion as it is formed. This may keep the wound dry, but it deprives the patient of much of the nutrition that is taken through the stomach, as well as of the pancreatic secretion, bile, and the secretion from the mucosa of the duodenum itself. Such a deprivation may be very serious. Occasionally a small duodenal tube can be introduced through the mouth or nose and stomach and will pass the fistulous track into the jejunum, but of course in a duodenal fistula that has followed a Billroth-II partial gastrectomy this is impossible, and in other cases it is difficult. A gastroenterostomy done under a local anesthesia may be helpful, but before this is adopted some method of collecting the discharges from the duodenal fistula and returning them to the intestinal tract through a jejunostomy may be successful. In a patient of mine on whom I was forced to make an incision into the duodenum to extract a firmly imbedded stone in the end of the common duct, there was very marked sepsis and in spite of the precautions in suturing the duodenum that I have mentioned a large duodenal fistula resulted. A jejunostomy was done on the left side, and the secretions from the duodenum were caught as they accumulated in a kind of well-like arrangement made partly by a rubber ring and zinc oxide ointment, and withdrawn with a syringe, and placed in the jejunostomy tube which was connected with the barrel of a syringe attached to a wire frame over the bed. In this way the patient was fed rather freely and the partly digested food that extruded through the fistula was caught and immediately transferred to the jejunum. The patient eventually recovered.

Obstruction of the Distal Duodenum

Obstruction of the terminal duodenum may be from adhesions, bands, a stricture, a neoplasm, congenital atresia, or the superior mesenteric artery. That obstruction from the latter source may be a serious condition was impressed upon me by a patient with persistent vomiting who died soon after admission to the hospital, and necropsy showed the cause of death was a hugely dilated duodenum caused by pressure of the su-

perior mesenteric artery and the transverse mesocolon as it hung down and produced mechanical closure of the terminal duodenum. Occasionally a partial obstruction from this cause may be remedied by forced feeding and by posture in bed, but if it is not corrected by this treatment a duodeno-jejunostomy gives satisfactory results. This is done much as a gastro-enterostomy, using the most dependent portion of the dilated duodenum and connecting it with a loop of jejunum about 18 inches from the origin of the jejunum, so that too sharp a kink will not be made at its origin. The loop of jejunum and the duodenum are fastened to each other, after opening the mesocolon, with two tractor sutures of fine tanned or chromic catgut about 2 inches apart. Sometimes it is unnecessary to incise the transverse mesocolon, which may be included in the suture. These sutures are wrapped around a frame or held as tractor sutures while the adjoining segments of the duodenum and jejunum are united with a continuous mattress suture of fine tanned or chromic catgut. The tissues are well packed around with gauze, and a short incision is made in the duodenum and its contents are evacuated with a suction apparatus. This is about the middle of the proposed incision, and about ½ inch long. It is then extended until it is 1½ or 2 inches long, and a similar incision is made in the jejunum. A continuous lockstitch of tanned or chromic catgut is begun on the right side and unites the posterior margin of the wound in the duodenum to the posterior margin of the wound in the jejunum. It is continued anteriorly and when the original end is reached the suture is tied snugly. The first row of sutures is taken up as a continuous mattress or right angle suture and carried anteriorly.

Congenital Occlusion or Atresia of the Duodenum

Congenital occlusion or atresia of the duodenum is an unusual condition, but doubtless occurs more frequently than the statistics show. Ladd, of Boston, has written interestingly on this subject. During the past three years I have had three cases of complete congenital duodenal occlusion or atresia. All three of these patients were referred to me by two pediatricians, Dr. Thomas D. Walker and Dr. W. W. Falkener, of Newport News. These three cases represent my total expe-

rience with this lesion, but if three such cases are found by two pediatricians in one community within three years, it seems highly probable that many more similar cases elsewhere are not recognized and that the babies are permitted to die with a diagnosis of asthenia, improper milk formula, etc. It is extremely important to impress upon general practitioners and pediatricians their responsibility for making an accurate determination of the causes of persistent vomiting during the first few days of a baby's life. Careful roentgenologic examinations should be made if it seems that nothing is passing out of the stomach. When duodenal obstruction is demonstrated, operation should be immediately performed. This condition is far more urgent than congenital pyloric stenosis, which usually does not give symptoms until the second or third week in the infant's life, whereas in duodenal atresia the vomiting is continuous from birth.

In the three cases I have operated upon, the first was a baby girl, born six weeks premature. She was operated upon six days after birth, the operation being a posterior gastro-enterostomy. The baby died of shock and malnutrition four hours after the operation. Necropsy showed complete absence of the terminal duodenum; the pylorus and proximal duodenum were greatly dilated.

The second case, a baby boy, was operated upon at the age of five days. The operation was gastro-enterostomy, under ether anesthesia. The baby made a satisfactory recovery, and when last heard from, about two months ago, the baby was fifteen months old and was in excellent health.

The third baby was a girl three days old. A duodeno-jejunostomy was done. The baby developed pneumonia, and died three days after the operation. Necropsy showed that distal to the anastomosis the duodenum ended in a blind pouch, and there was not even a fibrous cord between this and the jejunum.

A gastro-enterostomy, or possibly a duodenojejunostomy if the occlusion is in the very distal portion of the duodenum, differs from a similar operation performed in adults. The babies should have hypodermoclysis of salt solution and the administration of salines by rectum. The operation may be done under local anesthesia with the baby sucking a sugar-

rag, but if drop ether anesthesia is carefully administered it will prevent the extrusion of intestines which may occur suddenly during straining while the baby is under local anesthesia. The jejunum in these cases is quite small, not larger than a quill. The transverse mesocolon is veil-like and transparent, and it is not necessary to incise the transverse mesocolon, which may be included in the suture. Fine silk in a small curved needle is the best suture material for these cases. Two tractor sutures are placed between the loop of jejunum that it is proposed to unite to the stomach, and the posterior wall of the stomach, and are clamped and held taut. In very young infants the contents of the stomach and upper small intestines are practically sterile, but a small moist gauze pack should be placed around the site of operation.

On account of the small size of the intestines, too much suturing is undesirable, so, instead of inserting a preliminary continuous suture between the jejunum and stomach before incising the stomach and jejunum, the incisions are first made, and a row of silk sutures, placed as a continuous lockstitch and drawn snugly, is the only suture used posteriorly. This line of sutures, accurately placed, is safe. When it is brought anteriorly, however, there is some difficulty in making as smooth a union as in the posterior wound, so an additional row of sutures is inserted anteriorly, and this may be reinforced by a few interrupted mattress sutures of fine silk.

Because of the active peristalsis of the stomach and intestines, and the possibility of rapid absorption of catgut, together with the fact that the danger of the use of silk in the stomach is generally much over-rated, silk or linen is always used in these cases.

It is highly important that there be no obstruction to the afferent or efferent loop. The lumen of the bowel is so small that an obstruction could easily occur. Using only one row of sutures posteriorly lessens such a possibility.

COMMON BILE DUCT OBSTRUCTIONS

J. D. HIGHSMITH, M. D., F. A. C. S.
Fayetteville, N. C.

THE common bile duct, a continuation of the hepatic duct after its union with the cystic duct, is about 7 cm. long and normally its lumen is about 3 mm. in diameter. It runs in the right border of the lesser omentum, anterior to the foramen of Winslow. It passes behind the superior portion of the duodenum and then runs in a curve in the posterior surface of the head of the pancreas, where it lies in front of the inferior vena cava. At times it is completely embedded in the substance of the pancreas. For a short distance it lies along the right side of the terminal part of the pancreatic duct, and with it passes obliquely through the wall of the duodenum. The dilated union of the two ducts is known as the ampulla of Vater.

The surgical treatment of diseases of the biliary tract has been concerned chiefly with affections of the gallbladder. In considering the good and bad in this field of surgery, the common bile duct stands out above everything else: it plays the principal role in our successes and failures. The common bile duct is indispensable yet it is so readily affected by discase and operative trauma that its surgical importance can scarcely be overestimated. Frequently the results of surgery of the biliary tract depend upon the condition of the common bile duct.

The important factor in all surgical lesions of the larger bile ducts is the degree of obstruction to the flow of bile from the liver to the intestines. Thus common bile duct obstruction affects the liver, just as ureteral obstruction affects the kidney. Our object, therefore, should be to increase our skill both by clinical observation and the diagnostic aids at our disposal. This will help in reducing the number of "end-stage pathology" cases we are operating upon. It should not be necessary for us to wait until we have jaundice, biliary tract infection, dilatation of the biliary tree, hepatitis, and pancreatitis before we are ready to urge operation. By means

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of early operation we can prevent much of the damage to distant and adjacent organs and tissues.

The history of the illness is most important: if carefully taken it will assist more than any other one factor in helping us arrive at an early diagnosis. A diagnosis of stone in the common duct causing obstruction is made from the history of repeated attacks of colicky pain in the upper abdomen followed by evidence of jaundice. The history of colicky pain years ago followed by slight jaundice is of great significance in the consideration of an illness marked by pain, fever, chills and localized tenderness in the upper abdomen. When a patient has recurring attacks of upper abdominal pain with fever and jaundice and a history of a previous cholecystectomy with long drainage of bile after operation, we suspect stricture of the common duct. The history of slowly increasing and persisting jaundice with marked weight loss with or without attacks of colicky pain suggests malignancy involving the common duct and obstructing it The history of an illness often in a young person starting with malaise, indisposition, slight fever, digestive disturbances, and followed by jaundice which gradually grows less severe, is in turn suggestive of an infectious jaundice. The presence of jaundice in any patient should be considered due to obstruction to the free flow of bile through the common duct until proved to be due to some other cause.

There are several simple tests of great value in helping to determine if the jaundice is obstructive, toxic or hemolytic in origin. Examination of the stool for bile is important, since the presence of bile shows that the common duct is not completely obstructed. Duodenal drainage is of great value in deciding whether or not bile is passing into the duodenum through the common duct and whether or not infection is present. It can be used even in seriously jaundiced patients when cholecystography is contraindicated. If we obtain infectious material, pus or debris through the tube, this is good evidence of infection plus stone formation. The urine should always be examined for bile. The daily examination for urobilin is of some diagnostic value. If urobilin is present the common duct is not completely obstructed, and one must think of a toxic or hemolytic origin of the jaundice. If not due

to the excessive destruction of red blood corpuscles, urobilinuria is evidence of the liver's failure.

There are several other tests of liver function, but none is altogether satisfactory. Graham considers iodeikon the most valuable. The bromsulphalein test of Rosenthal and Whitt is the safest. We have no safe, simple, standardized test of liver function such as we have for renal insufficiency. The van den Bergh test and the icterus index are useful in determining latent jaundice.

Some of the various conditions which may produce obstruction of the common bile duct are stones, strictures, inflammation, ulceration and carcinoma; and as the common bile duct is in intimate relation to the gallbladder, pylorus, duodenum and pancreas, it is affected by diseases of these organs. The most common causes, from a surgical standpoint of obstruction to the common bile duct are stones, tumors of the head of the pancreas, malignant or inflammatory, impinging upon the common duct and producing complete or partial occlusion, and strictures of the common duct—frequently a result of injury to the duct during operation on the gallbladder.

Stones in the Common Duct

The frequency of stones in the common duct as shown in the figures given by Courvoisier from post mortem records at the Basle Pathological Institute is 3.9 per cent of all cases of gall stones, and 0.4 per cent of all post mortem examinations in a series of 2,500 post mortem examinations. As regards the most common location of stones in the common duct, there is a great deal of difference of opinion. In 123 cases Courvoisier found that the calculi were present throughout the whole common duct in 26; in the upper portion in 17; in the middle segment in 19; close to the duodenum in 20, and in the orifice of the biliary papilla in 41. In almost half of the cases, the stone was close to the lower end of the duct. Out of 380 cases, Mayo Robinson found the stone at the duodenal end in 67 per cent, in the middle portion in 18 per cent, and at the upper end in 15 per cent. Vautrin, however, out of 47 cases, found calculi in the part of the duct above the duodenum in 27, in the part in contact with the duodenum in 18 and in the ampulla of Vater in 2 cases. The number of stones

which may be found in the common duct is subject to great variation. In some cases, both hepatic ducts and the common duct are plugged with a soft, clay-like material which resembles putty very closely, both in appearance and consistency. In other cases, there are many faceted stones; and in still others, there may be single spherical stones. In the majority of cases there are stones in the gallbladder also.

The cases below illustrate the different types of obstruction. The absence of jaundice in no way precludes the diagnosis of partial obstruction of the common duct. A case in point is the following:

CASE 1. Mrs. L. T., aged 27, was admitted Aug. 19, 1932. Her chief complaint was severe abdominal pain. She had been having attacks of "kidney colic" for years, but during the few months previous to admission the attacks had occurred two or three times a week with intense abdominal pain in the right side near the costal margin, radiating to the scapula and up to the right shoulder, and associated with vomiting. Her digestion was poor, her appetite good. There was epigastric heaviness and distention and gas after meals—especially foods containing fat, or fibrous vegetables. She had never been jaundiced, nor had ever had any urinary or menstrual disturbances. She had been married for several years, but had never been pregnant. A little more than one year previous her appendix, both tubes and one ovary had been removed at another hospital.

Physical examination was essentially negative except for marked tenderness over the region of the gallbladder; the gallbladder itself was not palpable. There was also tenderness in the right costo-vertebral angle. The tonsils were enlarged and ulcerated.

Cystoscopic examination was negative. The van den Bergh test showed a very faint, delayed, direct reaction. The icterus index was 5. On September 3 her tonsils were removed by Dr. W. P. McKay. A week later, under spinal anesthesia incision was made in the upper right quadrant. The gallbladder was small, white and filled with stones. There were many adhesions. The common duct was distended and inflamed. The gallbladder was mobilized, the common duct opened through a longitudinal incision, and many small stones and much sand were removed. The gallbladder was removed, and the common duct drained after the removal of the stones with a Deaver T tube.

When seen in April, 1935, the patient's condition was satisfactory.

The principal points of interest in this case are that:

1. The patient was a young woman, only 27. Evidently she had had marked pelvic inflammatory disease which, I believe, was an important factor in the inflammatory condition of the biliary tract.

2. She had never been jaundiced, but jaundice is entirely absent in approximately 25 per cent of cases of common duct stones.

3. For years she had been treated for kidney colic.

In the presence of obesity and circulatory weakness in old patients with gallbladder empyema, the conservative treatment may be tried but cholecystostomy and removal of pus and stones under field block anesthesia is in the large majority of cases the only way out of a difficult situation.

CASE 2. Mr. E. H., aged 71, was admitted on Oct. 24, 1932, with chills, fever, abdominal pain and intense jaundice. About eight days before coming to the hospital he had been taken abruptly ill with intense pain in the epigastrium accompanied by a chill and nausea. High fever followed with the pain remaining localized at the xiphosternal juncture without radiation to the right shoulder or right angle of the scapula. The pain was of such severity that a doctor administered morphine. The attacks occurred daily, and the patient came to the hospital seeking relief. There had been a loss of 20 pounds in weight during the previous six months. He had not been able to do much work on account of pain and feeling of fatigue and chilliness.

For 38 years he had had attacks of dyspepsia with epigastric pain relieved by vomiting. In 1922 he had been jaundiced for several weeks. He said he had had chills and fever due to malaria when a young man. In 1917 he had had what was diagnosed as "typhoid dysentery" for two weeks. He had had attacks of palpitation with dyspnea since 1897. On admission to the hospital, in addition to gallbladder symptoms, the heart was failing. This patient was given glucose and subpectoral saline and digitalis daily. The jaundice gradually improved, as did the heart, and he was operated upon Nov. 4, 1932, eleven days following admission.

Under spinal anesthesia plus field block an upper right para-median incision was made. Upon opening the peritoneal cavity the gallbladder was not visible due to adhesions surrounding it. After these had been freed the viscus was found much distended, with thick walls and dilated blood vessels. There was considerable hepatitis and an enlarged cystic gland. The common duct was the size of the index finger. We were successful in milking a stone about 1 cm. in diameter impacted at the ampulla back into the common duct where it was removed. The common duct was drained with a Deaver T tube and the gallbladder was removed from below upward. The gallbladder itself contained 8 calcium oxalate stones.

This case illustrates some of the results of delay in surgery of the biliary tract. It was clearly evident that he had a common bile duct stone 10 years earlier at which time he had been jaundiced for several weeks. It was hard for this patient to give a clear history as to exactly how long he had

been suffering from these attacks of indigestion; it seemed to have been over thirty years. I believe that the "heart attacks" were secondary to the infection in the biliary tract. We can date this back thirty years or more. He has been entirely free from all symptoms since his operation.

The jaundiced patient is a poor surgical risk, so when possible we clear up the jaundice before operating. However if this cannot be done, I believe we should still operate, for many a time such a patient can be saved.

CASE 3. Mrs. L., aged 54, was admitted on Feb. 28, 1931, deeply jaundiced. Her trouble had begun with an attack of acute indigestion on February 3. Four days later she had become jaundiced and since that time the jaundice had increased. Before being admitted to the hospital, she had been treated at home by intravenous glucose and intravenous calcium chloride. The glucose was continued following her admission to the hospital. She rapidly became worse and was almost in a state of cholemia when operation was decided upon. According to the patient's daughter, she had had attacks of indigestion for five years, the attacks usually coming on about once a month. She had lost a good deal of weight. There was tenderness in the upper right abdomen.

A preoperative diagnosis of obstructive jaundice due to malignancy in the head of the pancreas was made. A Bevan gallbladder incision was made. The pancreas was not much enlarged. Marked hapatitis was present. The gallbladder was small, contracted, embedded in a mass of adhesions. Its walls were thick and gangrenous. About 2 ounces of foul pus was evacuated from the gallbladder, and a large stone impacted in the lower end of the cystic duct and encroaching on the common bile duct was removed, and the gallbladder drained.

This next case illustrates the importance of a two-stage operation on the biliary tract in old patients who constitute poor surgical risks. We frequently have patients from whom we can simply remove gallstones, whereas the patient could not possibly survive cholecystectomy or choledochotomy.

CASE 4. Mrs. M. B., aged 76, was admitted on July 4, 1929, complaining of upper abdominal pain and jaundice. She said that for the past fifty years she had had gallbladder symptoms with upper abdominal pains. When she was younger she would have freedom from pain for a year at a time. Since an acute attack five months previously she had not been free from characteristic symptoms of upper abdominal pain, and she had been intensely jaundiced. There had been occasional attacks of chills and fever, associated with severe colicky pains. The blood pressure was 170/75. Auricular fibrillation was present. The icterus index was 27. A mass was present in the region of the gallbladder. The heart was digitalized. She was given calcium chloride intravenously and hypodermoclysis daily.

At operation on July 17, 1929, under field-block anesthesia, a dense mass of adhesions was found in the gallbladder region. The colon and stomach both adhered to the gallbladder. The gallbladder opened at its fundus revealed one large stone the size of a turkey egg and 12 smaller ones. One impacted in the mouth of the cystic duct was removed with difficulty. There was a diverticulum of the gallbladder which contained 4 large stones. After removal of the stones, a rubber tube drain was placed in the gallbladder, with a cigarette drain beside the organ and one in the foramen of Winslow, and the incision was closed. This patient would not have stood any operative trauma to the bile duct. It was suspected at the time that there were stones in the duct. After the cholecystestomy, she did nicely and drained bile freely. Drainage of bile continued until Aug. 12, 1929. When she was discharged from the hospital on the 14th the wound was healed except for a small area at the site of drainage. The patient made an uneventful recovery. She was free from jaundice and much improved.

Some months later she was again seized with attacks of upper abdominal pain, chills and fever, about once a week. After the third seizure she came to the hospital again. Jaundice was not as intense as the first admission. The icterus index was 10, and the van den Bergh showed an immediate direct reaction. The blood pressure was 156/85. Digitalis was again administered for auricular fibrillation. She was given intravenous glucose and calcium chloride daily. Operation on March 17, 1931, performed under spinal anesthesia. The adhesions were carefully divided. The gallbladder was small and white, having almost obliterated itself. The common duct packed with calculi was easily found. At the ampulla a stone the size of an English walnut was broken into several pieces on being removed. There were several stones in the common duct, and right and left hepatic ducts. These were removed by suction. The ducts were irrigated and several small stones removed. A probe was passed through the common bile duct sphincter into the duodenum, and a No. 30 T tube was introduced into the common bile duct. Bile was now coming through the tube freely, and the incision was closed with drainage. The patient convalesced nicely except for repeated attacks of cystitis.

As a stone in the common duct affects the biliary tree and produces death in so many of these cases, we should know when to open the common duct and when not to. In any patient who has been jaundiced, the common duct should be opened and explored. In any patient who has a contracted and thickened gallbladder, the common duct should be opened and explored. In every patient who has a dilated common duct associated with stones in the gallbladder, the duct should be opened and explored. Reports from the Lahey Clinic are that in approximately 25 per cent of the cases with stones in the gallbladder, there are also stones in the common bile duct: in 39 per cent of cases of common duct stones there is no jaundice.

Tumors of the head of the pancreas, both inflammatory and malignant, will often give the same general symptoms as common duct stones as exemplified in the following case report:

CASE 5. Mrs. A. K., aged 54, was admitted on Dec. 22, 1930, on account of acute upper abdominal pain and jaundice. Her illness had begun five days previous to admission when she had been taken with chilly sensations and severe pain in the upper right abdominal quadrant while on her way from Pennsylvania to Florida. Following the pain she had been nauseated and had vomited. She had been relieved of her suffering with morphine. She stated that since childhood she had been treated at times for "bilious attacks" and for nausea and vomiting. She had been troubled with indigestion for a long time and had tried to avoid fats. It had been necessary for her to remain on a diet constantly due to hyperglycemia. In recent months she had had attacks similar to the present one: at the Jefferson Hospital in Philadelphia she had been advised to have an operation for stone in the common duct.

Physical examination was essentially negative except for severe jaundice and marked tenderness over the region of the gallbladder. The van den Bergh showed immediate direct reaction, and the icterus index was 15. She was given daily intravenous glucose and hypodermoclysis. Operation was performed on Jan. 3, 1931, under spinal anesthesia. The gallbladder was distended, pale and grayish white in color. The blood vessels were congested. The walls of the gallbladder were very thick. There was considerable hepatitis, but no stones could be felt in the gallbladder. The pancreas was much enlarged and hard, a chronic interlobular pancreatitis, I believe. The common bile duct was opened and explored. No stones could be found in the common duct nor in the hepatic ducts. A probe was passed without much difficulty through the sphincter of Oddi into the duodenum. I believe this patient was suffering from a pancreatitis secondary to her cholecystitis. The common duct was drained with a T tube and the gallbladder was removed. The T tube was allowed to remain in place for two months.

When last I heard of her, about one year ago, she was doing extremely well. Blood sugar has remained normal since the operation.

Malignancy of the pancreas of one of the larger bile ducts is rarely amenable to operative procedure. Much relief for these patients from the intolerable itching and jaundice, however, can often be obtained by anastomosis of the gallbladder to the stomach or duodenum. When this operation has been successfully performed, the duration of the patient's life is perhaps slightly prolonged. In certain rare instances, in which every evidence seems to point to the presence of an obstructive malignancy in the bile ducts, silent common duct stones will be found at operation. I have seen this in our operative experience, and also in the autopsy room. Almost every case of obstructive jaundice which appears to be due

to malignancy should be explored before the patient is given up as hopeless.

CASE 6. Mrs. N. R., aged 58, was admitted on August 25, 1928, because of pain and a mass in the upper right quadrant of the abdomen of two months' duration. She thought the mass was her right kidney; in fact, she had been told so. She had lost 20 pounds, during the previous three months. She was extremely jaundiced.

The patient had eleven children living and well. She had suffered from much gas, indigestion and fulness after eating for many years. A cystoscopic examination showed both kidneys to be normal. Following the usual preoperative treatment, operation was performed on Sept. 3, 1928, nine days following admission. An incision in upper right abdominal quadrant revealed a large, tense and adherent gallbladder as large as a coconut. The gallbladder was aspirated of a large quantity of colorless fluid. Three large stones were removed. There was a hard, indurated tumor involving the common bile duct and extending up to the juncture of the common with the cystic duct. There were several nodules in the liver. The pancreas did not seem to be involved. Cholecysto-gastrostomy was performed. I felt in this case that the cystic duct was probably not patent and the progress of the patient following operation proved that the duct was not patent as the jaundice did not disappear. She was discharged from the hospital, however, three weeks after operation, improved though still jaundiced. She died about nine months after leaving the hospital still intensely jaundiced.

CASE 7. Mr. W. G., aged 45, was brought to the hospital on February 8, 1927, complaining of gallbladder trouble and jaundice. The trouble had begun four months previous to admission with what he thought was acute indigestion. Pain of several hours' duration was associated with considerable nausea though he could not vomit. About three days after the onset he had noted jaundice. The jaundice with continued fever lasted about two weeks, and cleared up in November. Two weeks previous to admission he had acute pain in the gallbladder region, with fever and jaundice and occasionally chills. There was loss of appetite, "gas" and acholic stools.

The operation, performed on Feb. 11, 1927, under paravertebral nerve block anesthesia disclosed a much distended gallbladder with many adhesions and a marked hepatitis. After separating the adhesions the gallbladder proved to be gangrenous and friable and appeared to have perforated into the colon. It contained considerable gray-brown foul pus, and one large stone. The gallbladder was removed, and the common bile duct drained through the stump of the cystic duct. Bile drained freely. The patient did nicely. He left the hospital on March 7 free of jaundice and very much pleased with the operation. About six months later, he again became jaundiced, and had what he called bilious attacks. At operation on Sept. 20, 1927, the common duct was considerably inflamed with nodules in the region of the common duct and one nodule under the right side of the liver. One of these nodules was removed and proved to be adenocarcinoma. The primary lesion was probably in the common duct.

I believe that this patient had a carcinoma of the gallbladder at the time we operated. Had we obtained pathologic sections of the gallbladder, we would have known and our prognosis would have been different. We should always obtain a specimen for pathologic study in all cases, but especially in those with a history of trouble over a long time.

CASE 8. Mrs. G. R., aged 62, was admitted to the hospital on Aug. 6, 1932, complaining chiefly of jaundice, loss of weight, and an abdominal tumor. Sixteen months previously at another hospital cholecystectomy had been performed for relief of biliary colic and chronic dyspepsia, many stones being found in the gallbladder. The operation had been difficult on account of adhesions. She said that she drained bile profusely for several weeks following. She finally recovered, but she lost considerable weight, probably due to the loss of bile. She gained weight and felt well until December, nine months prior to her admission to this hospital when painless jaundice appeared abruptly, with acholic stools. The jaundice had varied in intensity, but had been present continuously ever since. Occasionally there had been nausea and vomiting but as a rule there had been a desire to eat. The abdomen had been tender for months but there had been little pain until May, when she had noticed a mass on the right side near costal margin. This had been enlarging. Since noting the mass, there had been considerable pain which required codeine and morphine for relief. There had been mild pruritus. The stools had been acholic.

She gave a history of gastric discomforts for twenty years. She had five children. A tender tumor in the upper part of the abdomen extended downward beneath the umbilicus and well over to the midline.

She was given daily intravenous glucose and hypodermoclysis. Two blood transfusions were given by the direct method. She gained considerably in weight and strength. Preoperative diagnosis: Extensive malignancy or some foreign body, such as a pack in peritoneal cavity. We decided to explore this tumor under field block anesthesia Aug. 26, 1932, twenty days following admission to the hospital. Incision was made about 6 cm. directly over the most prominent part of tumor about 10 cm. to the right of and slightly below the umbilicus. The liver was much enlarged. A large cavity containing about three quarts of bile-tinged fluid extended from the liver down to the pelvis. There was much necrotic material in the cavity. The incision was closed with the rubber tube drains. Following evacuation of this cavity, bile drained profusely, but there was never any bile in stools. Mrs. R. lost weight and strength. The case being apparently hopeless, we allowed her children to carry her home and she died shortly thereafter.

Stricture of the bile ducts is always followed by jaundice. The jaundice may be intermittent or permanent, depending upon the character of the stricture. While stricture may be the result of persistent obliterative cholangitis, most frequently it is due to operative injury. Hence, postoperative intermit-

tent biliary obstruction is always more or less suggestive of stricture of the common duct. A stricture that obstructs the common duct and causes retention of bile may lead to ulceration and perforation of the common duct on account of a diverticulum of the duct caused by obstruction in conjunction with weakness of the wall. It is well known that biliary obstruction following cholecystectomy, after which there is a history of profuse output of bile over a long period is suggestive of a stricture of the common or hepatic duct.

Stricture of the duct will often give a clinical picture closely resembling that of stone. In this case, there was a profuse discharge of bile following operation. This history was obtained from the patient and her daughter who both said there was profuse discharge of bile for several weeks, which suddenly ceased. After this she had been in fairly good health for a period of about six months, when she suddenly became jaundiced, and this jaundice was not associated with pain. Three months following the onset of this jaundice, a mass developed which was tender and progressively enlarging. At operation, the mass proved to be a tremendous abscess containing bile-tinged fluid and considerable necrotic material and pus cells. Evidently she had a common bile duct stricture which had ulcerated and perforated.

In conclusion, it may be said that 1, delay in operating in cases of stone in the common duct invariably leads to serious damage to the pancreas and liver; 2, jaundice should be considered as obstructive in origin until proved otherwise, and should be treated accordingly by means of early operation; 3, diseases of the common duct usually represent complications of diseases of the gallbladder and therefore are preventable by timely surgery. In three of the cases which I have reported, the gallstone disease had been present for 50, 38 and 4 years respectively, causing many severe attacks of colic. They were neglected cases and had an early operation been performed, we would no doubt have had better results.

SURGICAL MEASURES FOR THE PREVENTION OF GAS GANGRENE

GUY A. CALDWELL, M. D.
Shreveport, La.

DURING the past two years at the Shreveport Charity Hospital and in my private work, there have occurred 19 cases of gas gangrene of the extremities with ten deaths. The nine who lived escaped death only by the sacrifice of limbs. A careful review of the case records reveals the probability that, with proper management, eight of the ten deaths might have been prevented and six of the nine amputations might have been avoided. This mortality rate compared with 48.5 per cent during the World War, and 7 to 32 per cent as shown by several reports during recent years in civil practice indicates that some fundamental surgical principle is being violated. Examination of our case histories furthermore shows clearly what errors were made.

TYPES OF INJURY ASSOCIATED WITH GAS GANGRENE

INJURY	RECOVERED	DIED	No.
Compound Comminuated Fracture	4	4	8
Traumatic Amputation	1	2	3
Gun Shot Wounds	2	3	5
Lacerated or Punctured Wounds	2	1	3
Total	9	10	19

Correct surgical principles for the prevention and control of gas gangrene were carefully worked out during the World War, and these have not changed. The causative agent, modes of infection, early symptoms and progress of the disease remain the same. The use of a polyvalent serum for prophylaxis and treatment has advanced, but has in no way superseded the absolute necessity for early and effective use of the surgical measures as taught and practiced by army surgeons at the Front during the War. The whole difficulty is that these principles have been forgotten, or, that a new generation of surgeons has grown up who are not sufficiently impressed with their importance.

Read before the Seventh Annual Assembly of The Southeastern Surgical Congress in New Orleans, March 9, 10 and 11, 1936.

In order to discuss intelligently surgical measures for the prevention and treatment of gas gangrene, it will be necessary to review briefly the bacteriology and pathology of the disease. Several pathogenic organisms may produce gas in the tissues, but the one we recognize clinically in the great majority of cases is *Bacillus aerogenes capsulatus.* This organism is found nearly everywhere, in feces, in soil and dust from the fields and highways, in all parts of dirty clothing, in hair and gunwadding, in chronic ulcers and granulating surface wounds and on the perineal skin.

The germ is an obligatory anaerobe, a fact which has made possible almost complete surgical control of the infection. The spores will not propagate on the surface of the most attractive culture media unless deprived of oxygen. For this reason it exists frequently as a harmless secondary infection in many of our granulating wounds and surface ulcers and we are perfectly ignorant of its presence unless, for some reason, an anaerobic culture is taken on suitable media. The spores could be, and are, planted with impunity upon the injured muscles every time a guillotine amputation is done, but they never propagate or become pathogenic for the patient unless anaerobic conditions are created for them.

B. Welchii, requiring special food or media containing a certain amount of sugar will not multiply except on muscle that is deprived of oxygen, nor can it thrive in muscular tissue so long as the muscle has its normal blood supply. As soon, however, as a muscle is bruised or crushed and a small area is cut off from the circulation, it becomes ideal culture media and the organisms increase in number at a rapid rate. As the germs propagate, they produce gas which spreads between the muscle fibers for some distance. Since the muscle bundles are encased in an unyielding sheath of fascia, and since the organisms are capable of developing gas up to several pounds of pressure, the infiltration of the gas between the fibers forces out the blood, compresses and kills the muscle cells and thus creates more culture media for the growth of the bacilli. This pressure necrosis of muscle cells is further enhanced by the destructive action of toxins liberated by the organisms. The rate of advance, once the infection has gained a foothold, is extremely rapid. The progress along a given

group of muscles can be definitely noted within an hour and an entire lower limb can be destroyed in twenty-four hours.

The vegetative forms of this bacillus are readily destroyed by antiseptic solutions such as are ordinarily used in dressing wounds and they are particularly susceptible to the oxidizing agents. The spores, however, are very resistant. Practically, it makes little difference what antiseptic is used for the surface organisms that can be reached by a solution are already sufficiently inhibited by the presence of oxygen. The germs which make progress of the disease possible are those buried in the deeper, anaerobic crevices and pockets where the solution does not penetrate.

An increasing number of reports from various observers during the past few years indicates that the use of a polyvalent perfringens antitoxin is a valuable adjunct in the prevention and treatment of gas gangrene. There seems to be little doubt that the polyvalent sera are superior to the monovalent which were first used. All agree that the antitoxin can in no way replace surgical measures and that best results are obtained by combining the two.

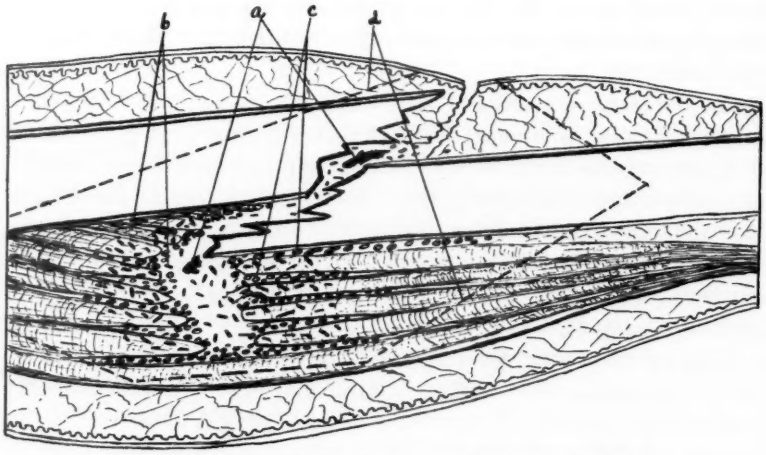
As a prophylactic measure, 1000 units are accepted as a standard dose and this is usually combined with and given in the antitetanic serum. When the presence of gas is noted in the tissues administration of 10,000 units of the polyvalent antitoxin, either intravenously or intramuscularly, is indicated and the dose should be repeated after four to eight hours.

Since the tetanus bacillus is an anaerobe and thrives under much the same conditions that favor growth of the gas bacillus, onset of tetanus after a single injection of the antitoxin is occasionally noted. Administration of a second or third dose is, therefore, indicated in cases which have developed gas gangrene.

Gas gangrene may be expected to develop in penetrating or lacerated wounds extending into the muscular layers when the wound has been directly or indirectly contaminated with soil or feces. The following table outlines the nature of the injuries in this series which resulted in gas gangrene.

Wounds originating as outlined are potentially infected with *B. aerogenes capsulatus.* The surgical measures that should be employed depend upon the length of time that has elapsed

since injury and the status of the circulation in the parts distal to the site of injury. For about twelve hours after a compound injury no marked extension of gas gangrene is expected. A debridement performed during this period can be directed simply to the tissues directly in the vicinity of the injury. After twelve hours, however, swelling will be apparent, the incisions should be longer, the inspection more thorough and the debridement much more extensive. When twenty-four



DEVELOPMENT AND SPREAD OF GAS GANGRENE

a. Soil-contaminated foreign body.
b. Bacillus aerogenees capsulatus propagating in an anaerobic focus and invading muscular tissue devitalized by trauma.
c. Gas bubbles spreading between muscle fibers. The blood supply of the muscular tissue is driven out and pressure necrosis of cells results.
d. Approximate size of area that should be exposed and excised to prevent spread of gas gangrene.

hours have elapsed before operation, several muscle groups may be involved throughout their full length, and there may be such general involvement of most of the muscles surrounding a bone that amputation becomes the safest procedure.

B. Welchii develops much more rapidly in muscles partially or completely deprived of blood supply. If, therefore, the principal arterial supply to a member has been lost, amputation becomes imperative. It should be remembered, however, that amputations done under such conditions are nearly always contaminated with organisms from the site of injury,

and even when the operation is done shortly after the accident, the stump should not be closed.

When amputation is deemed necessary, it should be done at, or above, the joint proximal to the gaseous invasion, and the stump should be left wide open. To many surgeons the term "guillotine amputation" seems to imply merely a circular incision. The muscles, fascia and skin are sutured and rubber tissue drains are expected to take care of any possible infection. Actually, of course, the basic idea of a guillotine amputation is a rapid division of the skin, muscles and bone in the same plane with ligation of the vessels and no closure whatever.

The surgical measures recommended and used during the World War for the prevention of gas gangrene were based on the bacteriologic and pathologic data outlined above. In the latter years of the War these operative procedures resulted in a greatly reduced mortality. We have not improved appreciably on this technic since the War. The gist of the surgical measures prescribed by the Army Manual is given in the following outline.

1. Operate as early as possible.
2. Use nitrous oxide anesthesia if possible.
3. Prepare the part with a minimum amount of delay and trauma.
4. Avoid tourniquets.
5. Make incisions longitudinally and half again as long as that thought necessary, both in skin and fascia.
6. Go between, rather than through, normal muscle and do not cut across them unless it be unavoidable.
7. Leave as much skin as possible.
8. But open the wound thoroughly and freely.
9. Excise all torn, crushed, discolored, non-contractile muscle until there is left only that which is firm, of normal color, actively contractile and which bleeds readily.
10. Make a careful and conscientious search for and remove all loose bone and foreign bodies, especially clothing and blood clots.
11. Stop the bleeding, LEAVE THE WOUND WIDE OPEN, and separate its walls with wet gauze LAID IN, not packed in.
12. Use Carrel tubes if it be certain that they will be properly cared for, otherwise omit them.
13. Use plenty of dressings and make careful splint fixation of the part.
14. Do it all as rapidly as is consistent with good technic.
15. When amputation is necessary, disarticulation should be done when feasible. If this is not possible, the guillotine amputation is the operation of choice.

Too much stress cannot, however, be laid upon the following points which were included in the above directions:

1. A long incision and thorough exposure.
2. The removal of all damaged muscular tissue and foreign bodies.
3. Leaving THE WOUND WIDE OPEN. No sutures, no tight packing.
4. When amputation is necessary . . . the guillotine amputation is the operation of choice, and this implies that the stump should be left *wide open,* not sutured.

These are important because by thorough exposure and removal of all damaged muscular tissue, the bacillus is robbed of its culture media and, by leaving the wounds wide open, such anaerobes as may remain cannot gain a foothold because of the presence of oxygen. Had these measures been faithfully applied to the nineteen cases presented in the following series, the deaths might have been reduced to two or less, and the amputations to at least three on the patients who recovered. Instead, however, the debridements almost invariably were followed by suture of the wounds with subsequent development of gas gangrene and the amputated stumps were closed with fatal results. The following abstracts of case records tell their own sad story of well intended but badly directed surgery with a terrible loss of lives and limbs resulting.

Report of Cases

Case 1. A negro was riding a mule which fell, pinning the negro's leg beneath its body. When seen at the hospital the following day, he was found to have a compound, comminuted fracture of the lower third of the tibia and fibula, but he had less than one degree of fever, his pulse was 104, the wounds were small and the swelling moderate. An immediate closed reduction was done followed by the application of plaster. Subsequent roentgenograms showed poor position of the fragments and the following day a second closed reduction was done, and still there was no record of suspicion of gas gangrene. On the fourth day after admission, however (five days after the accident), gas gangrene was recognized and amputation was done immediately above the site of fracture. The wound was closed with silkworm gut sutures and a rubber tissue drain inserted. During the next 24 hours the patient passed from shock into delirium with fever, with great swelling and discoloration of the stump, and died.

It is hardly necessary to comment that in this case with definite history of probable soil contamination, and particularly after the lapse of twenty-four hours, a debridement

should have been done, leaving the wound open. In the second place, when the presence of gas gangrene was finally recognized, the amputation should have been done at or above the knee and the stump should have been left wide open. Had the wound been debrided properly in the beginning, the negro's life and leg should have been saved; had the amputation been performed correctly, his life should have been saved.

CASE 2. A negro girl was seated in the rear of a truck with her legs dangling outside when the truck was stopped suddenly and a car close behind crushed both her legs just below the knees. She reached the emergency room several hours later in a state of shock with a pulse rate of 140. Restorative measures were employed and, after two hours, both legs were amputated through the upper third. The stumps were sutured with silkwormgut stitches and rubber tissue drains inserted at the angles of the wound. Two days later, subcutaneous crepitation was noted in both thighs. Multiple incisions were made into the muscular layers and perfringens serum given, but the patient died the following day.

Again, it appears evident that had the stumps not been sutured at the time of amputation, gangrene would not have developed and her life could have been saved.

CASE 3.—A man was admitted with an abscess between the fourth and fifth metatarsal bones which had developed following a punctured wound of the foot from stepping on a nail three weeks previously. The foot was moderately swollen and there was but little fever and a small draining sinus. The abscess was drained through rather small incisions, and for the next five days the foot was wrapped in compresses wet with a hot solution of magnesium sulphate. By this time frank evidence of gas gangrene was apparent and the leg was amputated at the junction of the middle and upper third. The stump was sutured and rubber tissue drains inserted. The patient lived four days longer. The notes do not indicate whether further advance of the gangrene was apparent, but the clinical course was typical. Although he had hypostatic pneumonia apparent on the last day, it is probable that his death was the result of extension of the original infection.

Here we see the errors of inadequate debridement at the beginning, delayed recognition of the presence of gas gangrene and amputation followed by closure of the wound.

CASE 4.—A man had fallen from the running board of a moving car and sustained a compound fracture of his femur. He entered the hospital the following day with considerable pain and swelling at the site of fracture. Multiple incisions were made in the thigh and tubes inserted for irrigation. The following day (second day after admission), gas gangrene was recognized and by this time the patient was almost moribund. Amputation was done

through the upper thigh and muscles at this level were all involved. The wound was left open, but the patient died three hours after operation.

The presence of gas gangrene should have been apparent at the time multiple incisions were made, and if a high amputation had been done at that time and followed with intensive serum therapy, it is probable that the patient's life could have been saved.

CASE 5.—A man riding on the side of a truck had both legs below the knees crushed by collision with a passing car six hours prior to admission. He was badly shocked, but responded to an infusion, and one hour later the right leg was amputated through the upper third and the stump sutured. The opposite leg, apparently having good circulation, was placed in a plaster cast. Later, on the same day, the left leg was amputated through the upper third and sutured. The next day a true guillotine amputation was done through the upper portion of the right thigh and the day following on the left thigh, but the patient did not survive the last amputation.

If the stumps had not been sutured when amputations were first done, the patient might have lived.

CASE 6.—A negro girl was shot in the region of the knee with a shotgun at close range. The wound was sutured by her local physician without doing a debridement or removing the gunwadding. Five days later, when she entered the hospital, there was extensive involvement of the entire thigh and buttocks with gas gangrene and she was almost moribund. Infusions were given and high amputation attempted, but the patient died on the operating table.

This patient's physician failed to realize that every wound inflicted by a shotgun at close range will almost certainly develop gas gangrene. A prompt debridement with the wound left wide open would probably have saved the patient's leg and her life.

CASE 7.—A young boy was riding on the fender of a car at night when the car crashed into the side of a bridge and both legs were hopelessly crushed through their lower thirds. He was brought to the hospital within an hour and immediate amputation was done through the middle thirds of both legs and the stumps loosely sutured. He survived the shock of the injury and the operations, but eleven days later developed gas gangrene of the right stump. Amputation was done through the upper third of the right thigh and perfringens serum given, but the patient died a few hours later.

This life could have been saved by not sewing up his stumps at the first operation.

CASE 8.—A negro girl had been bitten about the elbow by a mule and was brought to the hospital a few hours later. There were ragged lacerations

about the lateral aspects of the elbow and roentgenograms revealed a supracondylar fracture. Temporary splinting was applied and the arm dressed for two days and then a closed reduction was done and plaster applied. Three days later gas gangrene was apparent and although three doses of perfringens serum were given and the arm amputated through the upper third and left open, she died.

A debridement was definitely indicated with a wound inflicted in this manner. Had this been done and the wound left open, the patient should have recovered with her life and her arm. Even when this had not been done, the infection should have been recognized early enough to have saved her life by amputation. This illustrates the danger of encasing such a wound in plaster where the swelling and appearance of the wound cannot be observed.

CASE 9.—A man, who had accidentally shot himself with a shotgun, came in after six hours with the wound of entry at the elbow. An immediate debridement was done, but the wound was sutured afterwards and plaster applied. Two days later, gas gangrene of the tissues above the splint was noted and the arm was amputated in the upper third, but the stump was sutured with silkwormgut and the patient promptly died.

This wound should not have been closed after debridement, plaster should not have been applied after the operation and the stump should not have been sutured after amputation.

CASE 10.—A woman was admitted, who nine hours before had received a gunshot wound of the right thigh at close range. Her general condition was good and immediate operation was done. An incomplete debridement was performed and the surgeon evidently had some compunction about suturing the wound, for he left the skin wound open, but sutured the fascia. The patient rapidly developed gas gangrene extending up into the abdominal muscles and died in 48 hours.

The debridement should have been most thorough, no matter how much muscle had to be removed, and the fascia should not have been sutured. This life should have been saved.

CASE 11.—A boy, whose leg had been cut off by a train, was brought in nine hours later in a state of shock. After five hours, during which he was given various infusions and two transfusions of blood, an amputation was done through the lower third of the thigh and the stump sutured with silkwormgut stitches. He survived the operation, but it was noted that he developed undue swelling of the stump after 48 hours and all sutures were removed, perfringens serum was given and the wound cultured. He survived and the cultures showed the presence of *B. Welchii.*

This patient barely escaped death, first from shock and later from gangrene. Fortunately, the amputation was done above the knee and still more fortunately, the sutures were removed and serum given just in time to prevent spread of the infection.

CASE 12.—A young woman, who had sustained a compound fracture of the left leg and an extensive, deep laceration of the right foot in a car accident, entered the hospital three hours later in good condition. She was operated upon immediately, both wounds being debrided and sutured, and perfringens serum was given. On the third day after operation, the presence of subcutaneous crepitation in the right foot and lower leg was noted. Amputation was done through the middle third of the leg and the wound left open. The patient recovered.

Had the debridements been left open, it is probable that the amputation would not have been necessary.

CASE 13.—One hour after a patient had been shot with a large, lead pistol ball in the middle third of the leg, he entered the hospital and a plaster was applied to immobilize the fracture. A debridement was not done. A window was cut over the wound, and on the third day gas bubbles were noted in the discharge. Perfringens serum was given and a guillotine amputation done through the upper third of the thigh, and he recovered.

If a thorough debridement had been done at the outset and the wound left open, his leg should have been saved.

CASE 14.—A man was brought to the emergency room four days after having received a load of shot in the popliteal space from a shotgun at close range. He was in poor condition, but was sent to the ward without being dressed. Twelve hours later, although his condition was extremely bad, an amputation was done through the upper thigh where the muscles were frankly involved with the infection. Two doses of perfringens serum were given and he recovered after a rather stormy siege.

Had the patient been sent to the hospital promptly after the accident and a thorough debridement done, his leg might have been saved.

CASE 15.—A drayman's foot was caught beneath a piano that was being moved and the sole of his foot and heel was deeply lacerated and crushed. At the hospital, the wound was debrided and sutured, but after five days there was frank evidence of gas gangrene. Perfringens serum was given and the leg was amputated through the lower third and the stump sutured. Two days later, the gangrene had extended up to the knee. More serum was given, an amputation was done through the middle third of the thigh and the stump left open. The patient recovered.

Had the first debridement been left open, amputation would have been unnecessary; if the stump had not been sutured after the first amputation, the second one would not have been required.

CASE 16.—The foot of a girl who was riding a freight train was crushed in the coupling betwen two cars. Sometime later, she entered the hospital, the wounds were dressed and she was permitted to go to the ward. Three days later, gas gangrene was recognized, an amputation was done through the middle third of the leg and perfringens serum given. The stump was sutured with silkwormgut. Two days later, it was necessary to reamputate through the middle third.

Debridement should have been done on admission and the wound left open. The amputation stump should not have been sutured at the first operation.

CASE 17.—A boy fell 30 feet from a swing to the ground and landed on his outstretched hand. He fractured both bones of the forearm and the proximal fragments were driven some distance into the soil. The blood and nerve supplies to the parts were seriously injured and the muscles showed relatively little damage when the boy was operated on two hours later. The wound was carefully cleansed and devitalized tissues removed, and only one or two silkworm sutures were used to close the wound. Simple splinting was applied and the wound carefully watched. In 48 hours there was frank evidence of gas gangrene and the arm was amputated just above the elbow, the wound being left open. He recovered.

CASE 18.—A woman was brought into the hospital with an elbow that had been crushed beneath an overturned car. There were extensive lacerations, a badly comminuted fracture and much soil contamination. A careful debridement was done and a long skin flap was fastened over the upper part of the wound with one or two silkwormgut stitches. After 48 hours there were bubbles of gas in the wound discharge and amputation was done through the middle third of the humerus, leaving the wound open, and the patient recovered.

CASE 19.—A man's foot was crushed and the lower leg badly mangled in a car accident. He reached the hospital in a short time in a serious state of shock. The wound was dressed, temporary splinting applied and restorative measures began. He responded very slowly, and at the end of 36 hours, was still in a critical condition. There was frank evidence of gas in the tissues up to the knee. Amputation through the middle of the thigh was done without removing the patient from his bed, and the wound was left open. He made a rapid recovery from the gas gangrene, but remains, after two months, in a critical condition with a *streptococcus viridans* septicemia, which probably has its origin from an old lesion on his heart valves.

SUMMARY

1. A series of 19 cases with 10 deaths is presented and analyzed to show the errors resulting in a high mortality and amputation rate.

2. Deaths and amputations from gas gangrene can be greatly reduced by proper surgical measures.

3. To be effective, these procedures must be applied shortly after injury or early in the course of the disease.

4. Most important of the operative measures are:
   (a) Removal of all foreign bodies.
   (b) Excision of dead and dying muscular tissue.
   (c) Creation of aerobic condition in the wound by leaving it wide open.

5. The use of suitable splints rather than plaster for fixation of compound fractures, in order to make frequent and careful inspection of the wound.

6. The antiseptic solution employed as a dressing is relatively unimportant, provided the wound has been made sufficiently large and left wide open.

7. Perfringens antitoxin is a valuable prophylactic and therapeutic adjunct, but in no way displaces proper surgical measures.

EDMUND STRUDWICK, SURGEON

HUBERT ASHLEY ROYSTER, M. D.
Raleigh

THE most heroic figure so far recorded in the medical annals of North Carolina is Edmund Strudwick of the County of Orange. His character, his work, his life and his death were each marked by courage of the supreme type. His was a masterful mind, and with it there was a physical earnestness and a moral heroism scarcely to be surpassed. Edmund Strudwick was born in Orange County, North Carolina, on the 25th day of March, 1802, at Long Meadows, about five miles north of Hillsboro, the county seat. His lineage was ancient and long-established in the community, his father being an important political factor and distinguished for those qualities which afterward graced his son.

Doctor Strudwick received under the famous Bingham, the elder, what would now be called a high school education, though he did not finish the prescribed course of instruction, "so impatient was he to begin the study of the science to which nature seemed especially to have called him, and which he pursued with undiminished ardor, literally, to the last moment of his conscious existence." What was lacking in a classical education he made up by native ability and assiduous reading.

His medical studies began under Dr. James Webb, who stood to him almost as a father and whose place in the hearts of his people Doctor Strudwick subsequently filled. He was graduated as a Doctor of Medicine at the University of Pennsylvania on April 8, 1824. As a classmate of Dr. John K. Mitchell (the father of S. Weir Mitchell) and, with him, an office student of the celebrated Dr. William Gibson, young Strudwick became imbued with the best medical thought of the time. He served for two years as Resident Physician in the Philadelphia Almshouse and Charity Hospital.

Equipped with clinical experience, fired with enthusiasm and running over with energy, Doctor Strudwick in 1826 returned to his native heath and began the practice of medicine in the town of Hillsboro. From the very beginning he achieved success, soon becoming the commanding officer of the profes-

sion in that region of the country. Never was success more deservedly gained. Every attribute of his being contributed to the result, for not only was he blessed with a sound body and a warm heart but he had a superior intellect.

Doctor Strudwick never affiliated with any medical organization except the North Carolina State Medical Society. Of this he was a charter member and the first president (1849). The Society thus honored itself by launching forth under the name of a man who had already risen to an eminence rarely attained in his profession in those days. At its meeting in Raleigh he delivered a striking address, in which he urged education of the people to the necessity for autopsies. The following is a strong paragraph from this address:

"Neither the apathy of friends, the cold neglect and deep injustice of legislation, nor pampered quackery and empiricism can stay its onward course. True medical science will, like the majestic oak, withstand the shock and storm of every opposition. It has been beautifully compared to a star, whose light, though now and then obscured by a passing cloud, will shine on forever and ever in the firmament of heaven."

He took a lively interest in the work of the Society to his last days, though he practically never contributed to medical literature. The only case he ever wrote up was a death from ether by paralysis of the respiratory center. This paper was sent to his friend, Dr. I. Minis Hayes, then editor of the American Journal of the Medical Sciences, but was either lost in transit or found its way to the waste basket—at least, it was never accounted for. So that, the first and only case that this busy man ever recorded was one of which he had no special reason to boast—a death from an anesthetic—but reported from a sense of duty and honesty, and that one was never published.

The character of Doctor Strudwick's work was such as came to every country practitioner in his day. He was apothecary, physician, obstetrician, surgeon. And though he performed those duties as other men had performed them before him, there seemed to stand out in him something that was different, above and beyond the country doctor around him. It was the man behind the physician, the strong mental and moral force back of his activity.

Though Doctor Strudwick was a well-rounded medical man, his forte was surgery, and, had he lived in this day and generation, his name would be at the top of those who exclusively practice that art. Indeed, it is not saying overmuch to assert that no man to this time in North Carolina has made so enviable a reputation in surgery. When we consider the conditions under which he lived and labored, his work and its results were little short of miraculous. His reputation was not merely local, but during the '40's and long afterwards, he was doing operations in Raleigh, Wilmington, Charlotte, Greensboro, all the principal cities of the State. Numerous patients were sent to him, some of them from long distances. There was not a general hospital in the State then but he cared for his cases somehow and always gave them faithful attention. No modern surgeon in North Carolina has ever attained to such individual eminence. Nor were his results less wonderful. He attempted not only the lesser cases, but also those of magnitude, and this fact gives greater color to the results. All kinds of surgery attracted him and he sought them. Scores of operations for cataract were performed by him, according to the now obsolete needling method, without losing an eye. Once as he was driving homeward after a long trip in the country, he saw an old man trudging along being led by a small boy at his side. Doctor Strudwick stopped, ascertained that the man had been blind for twelve years, made him get up into the carriage and took him home. One eye was operated on first and the other the next week, sight being restored to each. This case as did all other similar ones interested Doctor Strudwick greatly.

If there was any special operation for which Doctor Strudwick was famous, it was that of lithotomy. Certainly he was the leading lithotomist of his time in North Carolina. There is no record of the exact number he performed, but it was large and his mortality was low. More calculi undoubtedly occurred then and Doctor Strudwick lived in a section of the State where this affection abounded. His custom was always to do the lateral operation and to introduce no tube or other drainage unless there was hemorrhage. It is said that he did twenty-eight consecutive lithotomies without a death. One case in particular has come down to us, a very large stone, wedged into the trigone and assuming its shape. On

the posterior surface grooves had formed along which the urine trickled down from the ureteral openings. After making the incision and finding that the calculus was too large to extract entire, Doctor Strudwick sent to the blacksmith's, secured his tongs and crushed it. Fortunately the stone was of a soft phosphatic variety.

Many breast amputations were done by Doctor Strudwick. In all cases he cleaned out the axilla, thus anticipating most of the surgeons of a later period. His after-results were in some cases quite surprising and were uniformly better than was the rule in those days. Numerous operations for strangulated hernia were done by him with a high percentage of recoveries.

He performed the operation for lacerated perineum several times, invariably using silver wire, but undertook no trachelorrhaphies. His practice was always to sew up a perineal tear immediately after confinement and his success in these recent cases was noteworthy. Another anticipation of modern methods was his habit of never employing applications to the interior of the uterus, but of advocating and using intra-uterine injections of salt solution.

The most important operation of Doctor Strudwick's career was one about which unluckily the record is meager. It was, however, in 1842 that he successfully removed from a woman a large abdominal tumor weighing 36 pounds. The nature of the growth is not made clear; most likely it was an ovarian cyst, but there are also evidences to suggest that it may have been a pedunculated fibroid.

It now remains to say something of the personality of Edmund Strudwick and to call up incidents in his life which show what manner of man he was. That he was a hero, morally, mentally and physically, can be attested by his deeds as they stand. Doctor Strudwick was built in a big mould. His soul could not conceive, his mind could not think, his body could not do, a little thing. A study of his career indicates that his ways were not the ways of the ordinary man, either in the medical profession or out of it. He was a master of men. And this was not an acquirement of age, but he was all his life a leader. His moral force in the community may be shown by his set determination never to allow doctors to quarrel. He simply would not let them alone until peace

was made. A favorite way was to invite the warring ones to his home at a certain time without giving them an opportunity to know in advance that they were to meet. This done, he usually accomplished his purpose. He was determined even to the point of stubborness. Just after the War Between the States, his most influential friends attempted with all their power to persuade him to take advantage of the homestead law, which was designed to permit Southern men to save a little during the reconstruction pillage, but he would not. Instead of this, he sold everything to pay his creditors and lived in a two-room house without comforts till he died.

In personal appearance Doctor Strudwick was attractive. His height was 5 feet, 10 inches and he weighed 190 pounds for the greater part of his life. He was exceedingly active and actually up to his final hours his energy was comparable to that of a dynamo. There was about him an intensity that was of itself commanding and overpowering. Underneath this exterior of rough force was a suppressed tenderness that came from a humane and sympathetic heart, and that let forth was as gentle as the outward manner was firm. The physician in that time was of necessity also the nurse. Here Doctor Strudwick showed his strength. Whenever he wished, for instance, a foot bath administered, he did not ask that it be done, he issued the orders, "Get things ready" and then with a detail almost unheard of impelled his untrained assistants to do his exact bidding. One of his special feats was what he called "lacing" a bed, making up an old-fashioned feather bed so as to render it a more comfortable resting place for his patient. It was this sort of care that contributed largely to his successful work. He never neglected a case. No matter how insignificant, how poor the patient, how far the ride, he pursued it with the same zest. He never stopped for inclement weather or swollen streams. He braved the former and swam the latter. Obstacles only seemed to increase his zeal to press onward.

His healthy body was a boon to Doctor Strudwick. Never but once in the working period of his existence was he sick. He had gone with his son to perform an operation. On the way out he complained slightly and having finished the task he became quite ill so that he had to be brought home lying down. He was nauseated, had a high fever ("calor mordax")

and was delirious on reaching his room. It proved to be scarlet fever. Though there was not a case then known in the county, and, while he had been exposed to it many times, he had never before contracted the disease. He was then about fifty years of age.

This fine condition of salubrity was aided also by his simple habits. He was not a big eater, and was extremely temperate. He never asked for a second portion of anything, but always took of each article what he thought was the proper amount for him to eat, finished it and would have no more. An oft repeated saying was, "I have never swallowed anything that I heard of afterwards." He also had the gift of taking "cat naps" at any time or place—a habit that William Pepper, of Philadelphia, did so much to celebrate. He was an early riser, his life long, the year 'round. And one of his invariable rules, which illustrates the sort of stuff of which he was made, was to smoke six pipefuls of tobacco every morning before breakfast. He was a most insatiate consumer of tobacco, being practically never free from its influence. What liberal contracts nature makes with some mortals!

In politics Doctor Strudwick was an ardent Whig, though he never sought or held public office. His sense of humor was shown when later in life he remarked to his son: "I don't know what I am coming to. Just to think I am wearing a slouch hat and a turned-down collar, and reading the New York Herald."

In religion he professed the creed of the Presbyterians and was an elder in the church. His interest in life and its affairs was forever keen and alive, particularly in any project for the public good. He was everybody's friend and an absolute paragon of cheerfulness. Even during his sudden reverse of fortune, his optimism never left him. But while he was friendly and gentle no one ever came down with more thundering tones upon those who were guilty of mean or unworthy acts.

Though his heart was chiefly in his surgery, yet Doctor Strudwick showed great fondness for every branch of the profession. He bought all instruments and books as they came out. All his spare time he spent in reading medical literature. He devoured knowledge voraciously and thoroughly digested it. His study of a subject was exhaustive. For a goodly part

of his time he rode on horseback, and he was a superb horseman. When he went in a vehicle, he used a surrey, with a boy in front, so that he could read along the road. Many hours a day did he spend thus, acquiring information which he was ready at a moment's notice to put to use. In a flap on the dashboard he kept a bag in which were stored a small library and a miniature instrument shop. And often he would return with his carriage full of cohosh, boneset, and other plants, indicating his familiarity with medical botany. He prepared a good deal of his own medicine in this way. One of his favorite preparations was the use of sheep sorrel ("sour grass") for lupus. The herb was inspissated in a pewter spoon by exposure to the air and sun, and the resultant mass applied to the ulcerated part. It is said to have been efficacious. What reaction was produced and what substance was formed cannot here be said.

The crowning incident in the history of this great man happened when he was near the age of sixty years. Neither in fiction nor in real life has there been an example of firmer devotion to duty or more daring fortitude. The glorious deeds of William MacClure exhibited nothing that can compare to this one achievement of Edmund Strudwick. He was called to a neighboring county to perform an operation. Leaving Hillsboro by rail at 9 o'clock in the evening, he arrived at his station about midnight, and was met by the physician who had summoned him. Together they got immediately into a buggy and set out for the patient's house, six miles in the country. "The night was dark and cold; the road was rough; the horse became frightened at some object, ran away, upset the buggy and threw the occupants out," stunning the country doctor (who, it was afterwards learned, was addicted to the opium habit), and breaking Doctor Strudwick's leg just above the ankle. As soon as he had sufficiently recovered himself, Doctor Strudwick called aloud, but no one answered, and he then crawled to the side of the road and sat with his back against a tree. In the meantime the other physician, who had somehow managed to get into the buggy again, drove to the patient's home, where for a time he could give no account of himself or his companion; but, coming out of his stupor, he faintly remembered the occurrence and at once dispatched

a messenger to the scene of the accident. Doctor Strudwick was still leaning against the tree, calling now and then in hopes of making someone hear, when the doctor's buggy came up at sunrise. He got in, drove to the house, without waiting to have his leg put in a splint, and, sitting on the bed, operated upon his patient for strangulated hernia with a successful result!

What an inspiration is the life of such a man! Viewing it even from afar one cannot help seeing the sublime soul that was back of it all. He would have been no common man in any age in any place. It is to his surgical skill that extraordinary tribute must be paid. Were he living today, Edmund Strudwick would be the surgical Samson of our State. Indeed it is doubtful if any of us equal him in the work which he essayed to do. In these times with wide possibilities his fame as a specialist in surgery would rank high. Such estimates are not overdrawn, for Doctor Strudwick's position in his period was such as to admit of them—and more.

The going out of this great man's life was as tragic and unusual as his career had been brilliant and useful. In possession of his customary health, at the age of 77, he succumbed to a fatal dose of atropine taken by mistake from drinking a glass of water in which the drug had been prepared for hypodermic employment in an emergency. An account says that "he was buried in the cemetery of the Presbyterian Church at Hillsboro, the funeral being attended by almost the whole population of the town." But for the accident which terminated his life, Doctor Strudwick would by all reckonings have lived to an advanced old age and some of us might have been privileged to know him. Priceless heritage this—to have fellowship with those rare souls that stand apart in passing generations; eternal inspiration ours—to contemplate the life and character of Edmund Strudwick and to hold him forever in our memories as the very finest model of those whose days are spent in

> Battling with custom, prejudice, disease,
> As once the son of Zeus with Death and Hell.

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L. MINOR BLACKFORD, M.D. *Editor*

B. T. BEASLEY, M.D. *Managing Editor*

ROY B. MCKNIGHT, M.D. *Associate Editor*

GILBERT F. DOUGLAS, M.D. *Assistant Editor*

AUGUSTUS STREET, M.D. *Assistant Editor*

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A STEP FORWARD IN THE TREATMENT OF FRACTURES OF THE FEMORAL NECK

THE evolution of the treatment of fractures of the neck of the femur, which until the last decade at least has been considered to have been the unsolved fracture problem, is an interesting study of efforts expended in the solution of a difficulty apparently not thoroughly understood.

Various explanations of the high percentage of failures in obtaining union have been suggested. One of the most frequent perhaps depends, in our opinion, too certainly on the questionable nutrition of the head and neck. The results of a great deal of investigation to substantiate an inadequate blood supply have been published. Another popular explanation suggested, inasmuch as the fracture occurs with greater frequency in the aged, is that in old age bone repair is believed to be retarded more than can be explained satisfactorily on the basis of senile osteoporosis. Little or nothing, until Whitman published his technic, had been mentioned relative to the need of accurate reduction. Ledbetter possibly more than anyone else has been responsible for the stressing of accurate appropximation.

In relation to the interpretation of the over emphasis that we consider has been placed on the first explanation, may we

suggest that the frequent, apparent at least, rapid absorption of the neck demonstrates in itself an adequate circulation of plasma as capable of the usual preliminary absorption of fracture surfaces as supplying elements necessary in the normal repair process. Too often we feel that unless there exists a demonstrable organized blood supply, meaning arteries, arterioles, capillaries, venules and veins carrying red blood to the part, there must be a serious disturbance in nutrition and forget that after all it is the relatively unimportant-looking plasma that seeps through the capillary walls and bathes the cells, and not the whole blood with its complicated cellular contents, that maintains existence. The relatively increased density of the femoral head frequently seen several weeks after a fracture of its neck it is felt can be attributed to the fact that it is normally more dense than the surrounding acetabular bone and the atrophy of disuse is accentuated in the less compact pelvic bony structures.

In the interpretation of what we consider as a similar overemphasis of the second explanation, that is, senility, may we recall the frequency of non-union in young individuals who have sustained fractures of an identical nature. It is admitted that this fracture occurs almost invariably in elderly people and is rare in early or middle life. We, therefore, see very few except in the aged and it is consequently less of a general problem in younger individuals by and large. We feel quite certain that difficulty is experienced in obtaining union in younger patients who have sustained this type of fracture just as it is in the older individuals. The typical fracture of the femoral neck in the aged is really a trophic or so-called pathologic fracture as a result of senile osteoporosis; the fracture not infrequently happening while the individual is walking or standing, and is not associated with any true trauma, whatsoever. It is admitted that this osteoporosis in itself is a deterrent to firm weight bearing consolidation because of the thinning and absorption of trabeculae, but that it is felt that the local repair process in the more delicate bony framework goes on in a normal manner, but requires more time.

We feel that there are two chief reasons for the frequent failures in this problem. One is the lack of satisfactory apposition of fragments and the other is the failure in maintaining a satisfactory apposition until consolidation occurs.

Until the technic of taking lateral x-rays of the neck of the femur was evolved we never could be certain of a satisfactory reduction. Stereoscopic x-rays were not sufficiently reliable and I am of the opinion that a tremendous stimulus in the solution of this difficult problem resulted from the ability to get dependable lateral views.

The maintenance of adequate apposition, once obtained and proven by satisfactory x-rays, is practically impossible by any of the usual methods of treating fractures. Adequate immobilization by traction over the weeks required for firm consolidation, maintaining proper position all the while, is usually impossible, and if the traction is efficient tends to separate the fragments which, of course, is what is not desired. It is felt that the primitive use of sandbags in maintaining abduction and avoiding external rotation, is as efficient as the usual type of traction.

The maintenance of apposition by a plaster spica, such as described by Whitman, was a great advance in the treatment of this condition, and increased considerably the percentage of successful results. However, with the application of a well fitted plaster spica, after a reduction, even if the other leg is included, adequate immobilization cannot be assured. The inevitable atrophy of the patient and the possible change in position of the pelvis inside the cast is too prone to permit disastrous displacement of the fragments.

The distress incident to the wearing of such an extreme cast is a factor that must be seriously considered and some patients cannot tolerate it even at the start, let alone the weeks that are necessary for consolidation. The strain imposed on the knee as well as simply the prolonged immobilization frequently results in a permanent disability to that joint and always constitutes an additional hazard.

A practical internal fixation of an accurately reduced fracture without the necessity of any external retentive apparatus has been gradually evolved during the last ten or fifteen years, stimulated largely in America by Smith-Petersen's work, with later contributions by Wescott, of Roanoke, Moore, of Columbia, Thornton and Sandison, of Atlanta, Gaenslen, of Milwaukee, and others. In the last few years this method has been adopted as a routine procedure in many parts of the

country, and is felt will displace the other methods in cases that are amenable to any type of treatment.

In viewing the problem from a mechanical point of view, it is readily seen that very little is necessary to hold the head of the femur on the neck once it is placed in the correct position and held so as to prevent its slipping. The desirability of a coxa valga position of the femoral head can be readily appreciated in order to minimize the shearing force always present.

The so-called Smith-Petersen three-flanged nail seems to be a suitable method of holding the head in place. After satisfactory reduction, which I feel I must keep repeating is all important, the nail is introduced through the lateral subtrochanteric area, passed up the neck, and driven into the head as near its center as possible.

Other methods of internal fixation have been ingeniously devised such as the triple pin employed by Moore. It is feared that there exists a tendency for the triple pin to hold the fragments apart after the usual physiologic atrophy of the bone ends where with a single uniform flanged nail this zone of atrophy will be minimized by the pin slipping out a little as this atrophy occurs, allowing the parts to maintain close contact. This "settling" we have seen repeatedly after several weeks.

Smith-Petersen originally employed a wide exposure, but with the perfection of the lateral x-ray technic this has been found unnecessary, and an incision just large enough to expose the femoral cortex in the right place is all that is required. As a stainless pin is employed it is allowed to remain in indefinitely and weight bearing is started as soon as the x-ray shows it to be warranted. It is seldom justified short of six months, although many cases have been reported where weight bearing was started very early, even immediately.

The procedure must still be considered in its experimental stage and its true value has not yet been evaluated. Even if it does not improve the percentage of success obtained by the Whitman method, the freedom from apparatus enjoyed by the patient warrants its consideration. After one has struggled along for years with the Whitman cast, realizing it was not satisfactory and yet not having anything better, one is

deeply impressed by the placidity of convalescence of those unfortunate individuals.

Improvements in the technic of inserting the nail are still being worked out, and the procedure must be considered as an arduous one. The chief difficulty that exists now is the satisfactory necessary coordination of the x-ray work with the proper placing of the pin after proven reduction with as little exposure of the parts and with as much expedition as is consistent with the problem at hand.

The purpose of this editorial has been as much to call attention to, and give a brief rationale of a procedure based we believe on sound principles which is bidding fair to revolutionize the treatment of a difficult type of fracture, as to sound a warning that it is a difficult, complicated method that requires skill and experience in its accomplishment.

—J. WARREN WHITE, M. D.

C. JEFF MILLER

President of The Southeastern Surgical Congress
February 4, 1874—March 14, 1936

The first afternoon of the New Orleans Assembly of The Southeastern Surgical Congress, the distinguished surgeon who was to speak on "Surgical Consideration of Tumors of the Uterus" was ill. On a few moments' notice Dr. Miller graciously consented to speak in his place, and he delivered a masterpiece on this subject. As he ended, Dr. John Darrington exclaimed that it was the finest surgical address he had ever heard. Others remarked that his material had been brilliantly organized, and noted that he had spoken extemporaneously for a short hour without ever pausing for the exact word. The address was certainly one of the highwater marks of the convention. None that heard him suspected that he was not feeling his best, and Dr. Miller betrayed in no way that he was himself also ill. His illness, however, was realized by the Fellows of the Congress when he was not able to appear that evening to honor Dr. Matas.

Charles Jefferson Miller was born in Winchester, Tennessee, on February 9, 1874, the son of Charles and Elizabeth Johnston Miller. A year after his graduation from the University of Tennessee in 1893, he moved to New Orleans. In 1896, he married Miss Ada Parker, of Memphis.

Dr. Miller became Professor of Gynecology in the Tulane University School of Medicine and in the Tulane Post-Graduate Medical School. He was Visiting Surgeon at the Charity Hospital and Chief of the Gynecological Service at Touro Infirmary. In 1912, he was Chairman of the Section on Gynecology, Obstetrics and Abdominal Surgery of the American Medical Association. His textbook of gynecology was widely used.

Jeff Miller had a rare gift for friendship. One closely associated with him has said that his outstanding characteristic

Dr. C. Jeff Miller

was his common sense. This common sense reflected in his talks and writings gave them unusual clearness. His works were further polished with his great personal charm. His broad conception of his duties as a citizen, of his duties to those who wished to learn, of his duties to all unfortunates and to the negro must be mentioned.

A major in the United States Army during the World War, Dr. Miller held a higher commission in the Medical Officers' Reserve Corps at the time of his death. He was President of the Board of Trustees of the Howard Memorial Library and a former member of the Board of Control of the Leper Home of Louisiana. He took a leading part in other civic and educational enterprises, particularly in founding and financing the Flint-Goodridge Hospital for negroes.

One time President of the Orleans Parish Medical Society, the Southern Surgical Association, the American Gynecological Society, the American Gynecological Club, Dr. Miller accepted his unanimous election as President of The Southeastern Surgical Congress not, one may feel sure, because he wanted an additional honor, but because he saw in the office an opportunity for further service to his brother surgeons of the South. He took an ever-increasing interest in the Congress and, especially during the past year, few men did as much for the organization. As General Chairman of Committees, he more than anyone else was responsible for the success of the New Orleans Assembly. His lively interest in THE SOUTHERN SURGEON, his constant encouragement and kindly advice were invaluable: it is infinitely regretted that he did not live to write out for publication in these pages his last great address on gynecology.

Last September Mrs. Miller and their daughter were stranded for several days on board the *S. S. Dixie* on the Florida keys. Before they were rescued Dr. Miller had aged years. And, after forty years of hard work without ever sparing himself, the burden of perfecting arrangements for the Assembly of the Congress must have been too much. Twelve days after his great address, his last professional act, his heart gave way.

It will hardly be a breach of confidence to reproduce a letter from Miss Elizabeth Miller:

Wherein I have lost my father and my wisest and gentlest counsellor, you have lost a dear friend and professional associate. I know that the Congress will remember vividly his absence at their last meeting, and now they understand more than we did at the time.

He was pleased at the honor of the presidency conferred upon him by the Congress, and unfortunately his life was not long enough for him to fulfill this duty as conscientiously as he fulfilled all others.

I am sure that the Congress as a whole, and each member as an individual, can be counted among the groups which will keep the "Chief's" memory alive, both professionally and as a friend.

THE NEW ORLEANS ASSEMBLY

It is hard to say whether the man who has never been to New Orleans wants to go there more than the one who has already tasted of its charms. Anyway, everybody wants to go there. Even a second rate program would have provided hundreds of men with an excuse to get there. The Program of the Seventh Annual Assembly of The Southeastern Surgical Congress was no second rate program: one of the most distinguished speakers from another section termed it "the best-rounded, the best-balanced surgical program" he had ever enjoyed.

Dr. W. D. Haggard, President of the Congress, called the meeting to order at 9 o'clock Monday morning, March 9.

The Right Reverend James Craik Morris, Bishop of Louisiana, pronounced the Invocation.

Dr. C. Jeff Miller, General Chairman of the local committees and President-Elect of the Congress, then said in part:

"New Orleans welcomes the Southeastern Surgical Congress. . . . We are certain that in versatile New Orleans each one will find some angle of interest to strike a responsive chord in his heart-strings. If you have been here before, and I am sure the greater majority has at one time or another visited New Orleans, you will know just what interests you most and can immediately broaden your appreciation and enjoyment of that particular phase. But if you have never been to the Crescent City, we eagerly await the opportunity to make the 1936 meeting of The Southeastern Surgical Congress one of the high lights in your memory.

"The program of the Congress promises to be one of the best, if not the best, yet offered. A running glance over the list of scientific papers to be presented will convince you that some of the best minds of the country are here to give you the benefit of their experience and research. . . .

"For the ladies many special entertainments, including lunches and a tour through Frenchtown have been planned.

"The program of the meeting is crowded and will take most of your time. We hope that many of you who have never visited New Orleans before will remain after the meeting. . . . There will be much of interest for those who desire to linger and the members of the local profession will join in making your stay enjoyable.

"We hope you will find time to inspect some of our medical institutions. We are naturally proud of them and of the long roster of names of men who had abiding faith in them. We are especially proud of Tulane University, now over one hundred years old, which has by its progressive conservatism preserved and enriched the finest ideals of medical tradition which make New Orleans a medical center of the South. Within one hundred feet from where we are today stood the first medical department of Tulane University during more than fifty years of its early struggles. Among the many distinguished names on the roster, it would not be amiss to pay tribute to those of Thomas Hunt, Stanford E. Chaille, T. G. Richardson, Warren

Stone, Edmond Souchon, the beloved Ernest S. Lewis, who recently passed away at the age of 95 years, and Rudolph Matas, who we are happy to say is still hale and hearty and carrying on his amazing interest in the field of surgery.

"Charity Hospital is almost as old as the city itself and the story of its services to the indigent poor of the State and to the advancement of medical science is known throughout the world. You will also wish to see the Louisiana State University Medical Center upon the grounds of Charity Hospital; and further uptown, some of our private hospitals: Touro Infirmary, the Southern Baptist Hospital, the splendid new United States Marine Hospital, and our modern hospital for negroes—the Flint-Goodridge Hospital.

"For the moments of diversion outside the sessions of the Congress, New Orleans offers varied entertainment: A stroll through the Vieux Carré, rich in the romantic history of the city's past; a visit to spots made famous by Napoleon, Lafayette, General Andrew Jackson, Jean Lafitte and Dominick You, the pirates, and others too numerous to mention; a glimpse of the beautiful patios of the Quarter; the old houses with gallery railings of "iron lace"; the Place d'Armes, now Jackson Square, where twice was staged the transfer of Louisiana, first from Spanish to French dominion, and then to the Flag of the United States; the Cabildo where the Spanish Government held legislative sessions; the Pontalba Buildings, America's first apartment houses; the old French Market, where the Indians traded before the white man came. And when you are tired, pause to rest at one of the old Creole restaurants and try some of the dishes for which their cuisines are famous. When sated with the Old World charm of the French Quarter, cross Canal Street, the dividing line between the old city and the new, and you will find that the charm of New Orleans does not rest solely upon her past. The wide boulevards, the beautiful parks, the gardens full of bright azaleas, the modern harbor, the Lake front, our magnificent airport and, just outside the city, the new bridge across the Mississippi River, invite your inspection.

"We welcome you to New Orleans and to the Southeastern Surgical Congress. We hope your sojourn with us will be not only instructive and profitable, but happy and enjoyable."

Dr. Jerre Watson conducted with simple dignity the Memorial Services for the Fellows of the Congress who had died since the last meeting.

Dr. Archie Griffin
Valdosta, Ga.
Jan. 27, 1870—May 2, 1935

Dr. Samuel Clarence Dean
Anderson, S. C.
Feb. 4, 1884—May 17, 1935

Dr. Henry Marshall Fullilove
Athens, Ga.
Aug. 23, 1877—Nov. 17, 1935

Dr. Willis Foreman Westmoreland
Atlanta, Ga.
July 22, 1864—Dec. 4, 1935

The various papers read before the Assembly will be published in these pages: they need no comment now.

Dr. George Crile described graphically his trip to Africa last winter. He set up a laboratory in the jungle to study the weight relationships of the brain, thyroid, heart, adrenal and sympathetic plexus of some two hundred animals killed in their natural surroundings. The first of these was a mouse, the last an elephant. He illustrated in slides the differences between the crocodile and the tiger, and pointed out further differences in the same species in their native state and after years of captivity. We hope to be able to secure an outline of his talk for these pages.

Dr. John F. Erdmann was unable to attend the Assembly on account of his own illness. Dr. Miller substituted brilliantly for him in a discussion of the surgical treatment of tumors of the uterus. Dr. I. I. Lemann replaced Dr. Erdmann in his clinic hour and talked about the medical management of surgical patients with diabetes.

In the course of the meeting Dr. H. M. Branham, Dr. Rudolph Matas, former Officers of the Congress, and the Editor of the SURGEON were introduced to the audience.

Following the Monday afternoon session the Executive Committee had its annual meeting. The financial report was satisfactory, although the balance on hand was not quite as large as last year on account of the two additional numbers of THE SOUTHERN SURGEON that have been published. Except that the organization of Virginia has not yet been completed, gratifying reports were received from the component states. Florida, Georgia and South Carolina had relatively more active members than the other states, slightly exceeding 2.5 per cent of the total number of licensed physicians within their borders. It is particularly encouraging to note the great recent increase in the number of Fellows in Louisiana. Dr. Julian L. Rawls, of Norfolk, invited to attend the Assembly at the suggestion of Dr. I. A. Bigger, was also present. Invitations for the 1937 Assembly were received from Louisville, Atlanta, Birmingham and Jackson.

That evening, Dr. James S. McLester, of Birmingham, President of the American Medical Association, presented "Nutritive Failure as a Cause of Vague Ill Health." After Dr. Howard's paper, the meeting was turned over to the Orleans Parish Medical Society, Dr. Frederick L. Fenno presiding.

Dr. Fenno introduced Dr. Matas who told of his first visit to Havana as a boy of 19, to work on the first American Yellow Fever Commission, and of his coming under the influence of Dr. Carlos J. Finlay, who as early as 1879 had become convinced by lucid reasoning that yellow fever was carried by the mosquito. Dr. Matas' reminiscences were not only charming but also of great historical value. At the conclusion of his address Dr. Fenno introduced the son of Dr. Carlos J. Finlay, Dr. Carlos E. Finlay, who had come to this country for the dual purpose of addressing the medical convention in Dallas and of making Dr. Matas a Commander of the Order of Carlos J. Finlay. This Order was founded by the Cuban Government in honor of the scientific achievements of the elder Dr. Finlay. The Cuban

Government thus signally honored Dr. Matas in recognition of his work in yellow fever and of his having translated many of the elder Dr. Finlay's medical papers into English. After the decoration was bestowed, Dr. Finlay announced that he had also been commissioned by the Havana Medical Society to initiate Dr. Matas as a corresponding member.

Tuesday morning was devoted to a symposium on neurology. After the formal papers Dr. Paul G. Flothow, of Seattle, held a clinic in which he took up informally various neurologic conditions.

The afternoon session was marred by the absence of Thomas E. Carmody, of Denver, who was unable to come on account of illness. Dr. Arthur E. Hertzler's clinic was devoted to breast tumors. Dr. Hilliard E. Miller was allowed a few moments to present a case of echinococcus cyst of the uterus.

At the completion of the afternoon session the Business Session of all Fellows of the Congress was held. At this time Dr. Fred W. Rankin, of Lexington, Ky., was elected President-Elect and Dr. John Darrington, of Yazoo City, Miss., Vice-President. Dr. B. T. Beasley was re-elected Secretary and Treasurer. After consideration of the invitations for the 1937 meeting, the Fellows elected to accept the invitation of Louisville.

Dr. Miller being away with "flu," President Haggard served as Toastmaster at the banquet with his characteristic charm. Dr. Alton W. Ochsner proposed a toast to The Southeastern Congress. Dr. Mims Gage in light vein toasted the Ladies and Lucian H. Landry gave a delightful monolog entitled "The Cajun Doctor." After the banquet there was an informal dance.

The program for Wednesday was given as scheduled except that Dr. Haggard was unable to take his place on the program and Dr. Hertzler held a clinic on peptic ulcer instead. Unlike former assemblies, 78 men were present at the conclusion of the program.

The Round Table Discussions were a great success and provided an opportunity for those interested to ask further questions clearing up certain points. At the last of one of these Dr. E. C. Parker, of Gulfport, was called on to report an extraordinary case, the first successful one of its kind. Dr. Parker had already reported this case orally at meetings in Mississippi, but he has promised to submit it to THE SOUTHERN SURGEON.

More men from a distance, particularly from outside of the territory embraced by the Congress, attended the meeting than any of its predecessors.

The scientific exhibits were the most elaborate that we have as yet had in the annual assemblies. The U. S. Marine Hospital, Tulane University School of Medicine, Louisiana State University School of Medicine and the Atlanta Cancer Clinic provided altogether more than 800 items. Except as regards size, these exhibits were quite comparable to those of the annual sessions of the American Medical Association.

The U. S. Marine Hospital had a large orthopedic display and also one dealing with fever therapy.

The L. S. U. Medical Center and Charity Hospital was divided into several sections:

From the Division of Surgical Pathology:

Gastro-intestinal, gynecologic and urologic gross specimens, photomicrographs and full case reports by Drs. R. J. D'Aunoy, J. H. Connell and E. von Haam. Also, Lymphogranuloma Inguinale by Drs. D'Aunoy and von Haam.

From the Department of Orthopedics: Pneumoradiography of the Knee, a New Technic Demonstrating Its Value in the Diagnosis of Injuries of the Semilunar Cartilage, by Drs. H. Theodore Simon, A. Scott Hamilton and Charles R. Harrington.

A superbly illustrated exhibit of cancer pathology with many oil paintings by Dr. James T. Nix, Director of the O. K. Allen Tumor Clinic, with Drs. J. H. Connell, C. Gorman, W. Garcia and E. von Haam.

Tulane University School of Medicine and Charity Hospital presented an extensive exhibit subdivided as follows:

Use of Morphine in Ileus, by Drs. I. M. Gage and Alton Ochsner,

Peptic Ulceration, by Drs. Alton Ochsner, I. M. Gage, Michael DeBakey, Amos Graves, and Kiyoshi Hosoi,

Scalenus Anticus (Naffziger's) Syndrome, by Drs. Alton Ochsner and Michael DeBakey,

Amebic Hepatic Abscess, by Drs. Alton Ochsner and Michael DeBakey,

Subphrenic Abscess, by Drs. Alton Ochsner and Amos Graves,

Technic of Appendectomy, by Drs. Alton Ochsner and George Lilly,

Effect of "Stripping" in Ileus, by Drs. Alton Ochsner and Ambrose H. Storck,

Dyschondroplasia, by Dr. Howard R. Mahorner,

Fractures, by Dr. Howard R. Mahorner,

Pilonidal Sinus, by Dr. I. M. Gage,

Mesenteric Lymphadenitis, by Dr. J. R. Plank,

Plastic Surgery, by Dr. Neal Owens.

The exhibit of the Atlanta Cancer Clinic presented by Drs. W. M. Lake, A. J. Ayers, and J. L. Campbell, gave a beautiful and extensive display of gross specimens, of photomicrographs, and statistical tables.

The commercial exhibits occupied all the space available and proved so attractive that it was often difficult to assemble the audience after the intermissions for their inspection.

The local committees did splendid work. Without disparagement of any of the men who contributed to its success, special tribute must be paid to Dr. Ambrose H. Storck, Chairman of the Auditorium and Exhibits Committee, and Dr. Waldemar R. Metz, Chairman of Publicity Committee, for these two committees functioned perfectly. The management of the Roosevelt Hotel also assisted in making everything run smoothly and making everyone have a good time. In short, every promise and intimation of Dr. Miller's Address of Welcome was more than fulfilled, and the 1936 New Orleans Assembly will always be one of the high lights in our memory.

BOOK REVIEWS

The Editors of THE SOUTHERN SURGEON *will at all times welcome new books in the field of surgery and will acknowledge their receipt in these pages. The Editors do not, however, agree to review all books that have been submitted without solicitation.*

SURGICAL PATHOLOGY OF THE GASTRO-INTESTINAL TRACT. By ARTHUR E. HERTZLER, M. D. Surgeon to the Agnes Hertzler Memorial Hospital, Halstead, Kansas, Professor of Surgery, University of Kansas. 311 pages with 242 illustrations. Price, $5. Philadelphia, Montreal and London: J. B. Lippincott Co., 1935.

At the past three Assemblies of The Southeastern Surgical Congress few speakers have been received with as much enthusiasm as Dr. Hertzler. His written word is equally deserving of enthusiasm and his books are superbly illustrated. One marvels not only at the wealth of pathologic material presented, but also at the extraordinary patience of the man who was able to secure such wonderful photographs and microphotographs.

One gathers Dr. Hertzler believes that obstruction or perforation are the only indications for operating in a case of peptic ulcer, that cancer of the stomach is incurable, and that too many gallbladders are removed. Certainly there is just now a swing away from the tendency to operate as soon as possible after the diagnosis of peptic ulcer or gallbladder disease. But this reviewer for one would be loath to accept the doctrine that gastric carcinoma is never cured by the surgeon. At the same time he readily admits that this author is none the less interesting when he is attacking one's most cherished beliefs.

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References should conform to the style of the Quarterly Cumulative Index Medicus, published by the American Medical Association. This requires, in order given: name of author, title of article, name of periodical, with volume, page, month (day of month if weekly) and year.

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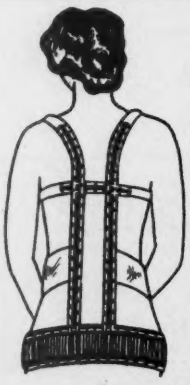

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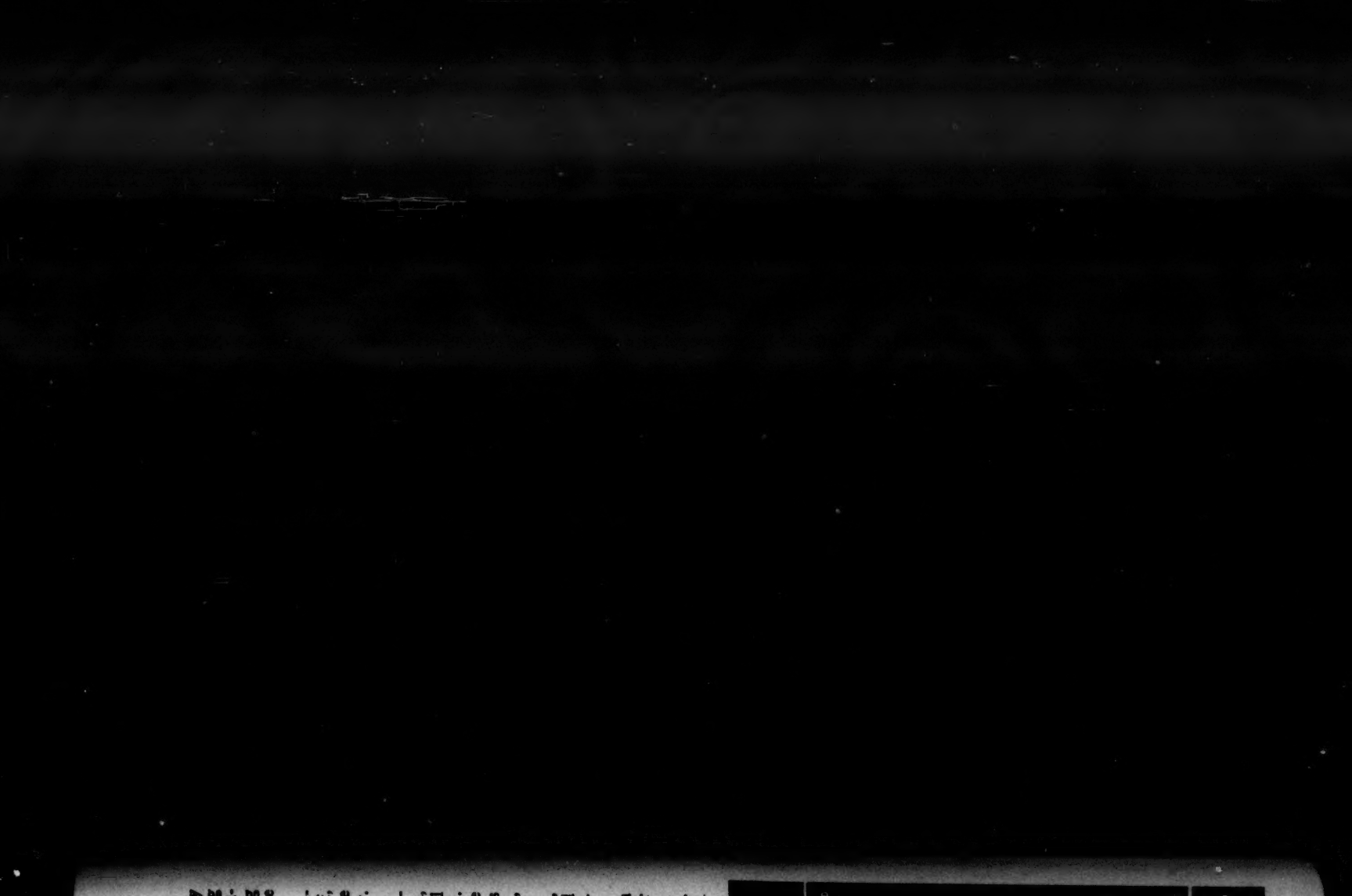
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